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SOME DIRECTIONS IN WHICH VICTORIAN AGRICULTURE MAY BE DEVELOPED.

Address given at the Melbourne Royal Agricultural Society's Show, September, 1919, by A. E. V. Richardson, M.A., B.Sc., Agricultural Superintendent.

Victoria holds a unique position in Australian agriculture. The State occupies only 3 per cent. of the continent, yet the volume and variety of its purely agricultural production exceeds that of any other State. It is by far the most densely populated State in the Commonwealth, and has made more progress towards intensive and diversified agriculture than any of the others. Strangely enough, it owes its pre-eminence in this regard largely to mining.

Sixty-eight years ago, the attention of the world was riveted to the remarkably rich gold discoveries in Victoria. In the ten years between 1851 and 1861, the population increased from 97,000 to 511,000, an increase in one decade of nearly half-a-million souls. The immigrants drawn from all parts of the world were lured by the extraordinary wealth that was being won from the soil. These ten years were the most fruitful and prosperous in the history of mining in Australia—perhaps in the world.

The total wealth won in this decade was nearly £100,000,000—an average of £10,000,000 per annum. Since then, the mining industry has steadily declined, until to-day its value is approximately one and a half millions sterling. It was, however, the gold mining industry that was responsible for the rapid settlement and development of the State, and it laid the foundations of permanent prosperity.

These sources of wealth have practically dried up. But to-day we have in our agricultural industries sources of wealth which, unlike mining, will never dry up, and which are already yielding more than four times the wealth that mining gave in its palmiest days.

During the past four years, we have reaped from our wheat-fields alone more wealth than was ever dug out of Victorian mines during any

four years in their history. The value of the Victorian wheat crop for the past four years exceeds £40,000,000. Truly, the wheat crop has proved a veritable gold mine to the State—a mine richer and more permanent than those that were worked in the heyday of Victoria's mining prosperity. There is this difference between the gold mine and the wheat-field: With an ordinary mine, the more wealth extracted the less remains for the shareholders. With agriculture, if carried out in conformity with the teachings of science, the more wealth won from the soil by cropping, the more wealth remains to be divided amongst the community, for with proper methods of culture, the soil must get richer and more productive and wealth-producing as the years roll by. This basic fact may be illustrated by considering the yields of the wheat crop.

The average yield of wheat per acre for the past ten years (including the 1914 drought year) is 12½ bushels. The average yield for the previous ten years was but 8¼ bushels; hence, instead of the soil being depleted, we are actually producing 50 per cent. more wheat per acre now than we did ten years ago.

The wheat-fields, the pastures, and stock are our greatest sources of wealth. They yielded last year over 40 millions of money—two-thirds of the total wealth produced in the State. This means that the farmers of Victoria produce wealth at the rate of over £100,000 every 24 hours.

The war is ended: the work of reconstruction begun: the war bill has to be met: There is but one way out. The Prime Minister has indicated it: Work and increased production; and when we say increased production, we mean essentially primary production, for primary production is and must remain our greatest source of wealth.

Now that the war is over, there is a grand opportunity for Australia to pour her surplus food products into Europe. They will all be wanted, and wanted urgently. There is at present a huge food vacuum in Europe. It will take the combined surpluses of America, Argentina, Canada, and Australia to fill it. In fact, the British Food Controller recently stated that the alleged world surplus of wheat was non-existent.

At the outset of the war, I published a series of articles on "Wheat and the War." In those articles, an attempt was made to show the effect of the great wars of the past on the prices of foodstuffs, particularly wheat. During the past 150 years, the price of wheat reached its highest levels immediately each war closed, and prices remained high for at least two to three years after peace had been declared. During the Russo-Turkish war, wheat rose from 5s. to 9s. 6d. per bushel, and remained at 9s. for three years. In the Franco-Prussian war, wheat rose to 7s. 6d., and remained at that price for three years. Will history repeat itself in this, the most disastrous cataclysm in history? I think so, for two reasons:—

1. Glance for a moment at little Roumania—a country considerably smaller than Victoria, which produced nearly as much wheat as Australia did in pre-war days.

Roumania was stripped and ravished by two years of enemy occupation, and despoiled even of household utensils, besides all farm implements, equipment, and animals necessary for the production of another harvest. According to a census recently taken by the Government of

Roumania, the following position was indicated so far as domestic animals were concerned:—

	1916.	1919.
Horses	751,000	149,000
Oxen	1,765,000	705,000
Sheep	5,550,000	445,000
Cows	1,680,000	420,000
Swine	839,000	84,000
	10,579,000	1,803,000

Can you picture what this means? What kind of a showing would Victoria make if we lost over 80 per cent. of our domestic animals in three years, and the major part of our agricultural implements and equipment?

We know how disastrously a drought which may take 10 to 20 per cent. of our stock affects us. But 80 per cent.! Then what has happened in Roumania has been repeated in Serbia, Bulgaria, Belgium, Northern France, Poland, Ukrainia, and the Baltic Provinces. And can you imagine what is going on in the richest agricultural regions of distracted Russia—with the Bolsheviks contending for mastery on a battle front of 1,000 miles?

2. The war has given the masses of Europe an idea of their power. In the social and industrial reconstruction going on in Europe, the masses will demand shorter hours, and higher wages, and better conditions of living. All this will tend to increase costs of production in Europe, and will indirectly favour Australia, where the workers already enjoy conditions for which the European workmen are striving.

It is reasonable, therefore, to conclude that the level of prices will be high, and that there will be a great demand for our surplus wheat, meat, wool, and dairy products.

These we can produce in abundance, and they will be produced in abundance if agriculturists are allowed to get the full fruits of their labour, and to obtain the full world's parity for their produce. That will be the greatest possible incentive to the farmer.

I have said that there is every probability of the level of prices of agricultural commodities on the world's market remaining high for several years. Possibly the pre-war levels will never be again experienced. There is every prospect of a profitable era of agriculture being ushered in. In what direction will our future progress lie? Briefly:—(1) In the further development of what are regarded as our staple industries—wheat, wool, dairying, meat; (2) the diversification of our agriculture by the more extensive growth and further development of crops now regarded as side lines; (3) the improvement of systems of marketing the produce.

If the State and the nation asks for increased production, it must provide facilities for the profitable absorption of the surplus products.

(1) A word or two regarding our staple products:—(*a*) wheat; (*b*) dairy products; (*c*) meat and wool. Victoria could easily double or treble its production of wheat. During the last twenty years the average annual harvest has increased from 13,000,000 bushels to an

average of 37,000,000 bushels—an increase of 175 per cent. The average yield per acre during the past decade has exceeded 12 bushels, as compared with 8½ bushels during the previous ten years. This increase has been brought about, notwithstanding the fact that during the past ten years nearly 1,000,000 acres of mallee country, with a low rainfall, and giving a low average yield per acre, have been brought under cultivation. But the average yield per acre could undoubtedly be raised to 16 or 18 bushels per acre by the more general adoption of the best methods.

In the various exhibits in the Government Pavilion we have attempted to define and illustrate these methods. We have attempted to show the methods which the most progressive of our wheat-growers are following. Frequently in the wheat districts you will find a barb wire fence separating the grower of a 30-bushel crop from the grower of a 10-bushel crop. The difference between the yields of those two farms lies, not in the quality of the soil, but in the quality of the farming. Wherein lies the difference?

Years of experience in the wheat belt has shown that the progressive growers adopt as their policy the following:—(1) Thorough working of the soil; (2) liberal manuring; (3) systematic crop rotation and the keeping of sheep on the farm; (4) rational use of seed.

Thorough working of the soil includes early fallowing and judicious working of the fallows through the summer to conserve the maximum of soil moisture.

Liberal manuring with soluble phosphates has been proved to be profitable in two ways:—(1) It produces the maximum crop of wheat; (2) it increases the stock-carrying capacity of the land by stimulating the growth of grass that follows the wheat.

Some form of crop rotation is essential if the wheat crop is to be kept free from fungoid diseases like flag-smut and take-all, and the fertility of the land is to be maintained. Besides, every wheat-grower should keep sheep either for raising fat lambs or for wool, and a rotation is essential for such a case.

In the Mallee areas wheat, pasture, bare fallow, is recommended; for the Wimmera wheat, oats, pasture, bare fallow; and for the more favoured districts wheat alternated with forage crops is recommended.

Rational treatment of the seed involves the choice of varieties suitable to your district, the grading of the seed and the use of selection to increase the producing power of the grain.

Besides these cultural methods the wheat farmer will need to pay more attention in the future to problems of marketing than formerly. It is one thing to produce farm products cheaply and efficiently. It is another thing to market the crops advantageously and expeditiously. The wheat must be got to the seaboard with the maximum of expedition and the minimum of expense, and the wheat should be sold on the markets of the world to the best advantage.

The farmers of Western Canada have organized a co-operative Grain Association to supervise the operation of elevators, and to sell their products in the markets of Europe. I see no reason why the grain-growers of Victoria cannot organize their forces with a view of disposing of the whole of their staple products on a co-operative basis.

Dairying Industry.

The dairying industry of Victoria is capable of great expansion. Our climatic and soil conditions are eminently suited for dairying. No other country, save, perhaps, New Zealand, has such a uniformly mild temperature, such rich pastures, or such natural conditions for the production of high quality and high grade dairy products. Yet our average production per cow does not compare favorably with countries which have poorer soil, climate, and pastures, nor can it be said that the quality of our products are what they might be.

It has been estimated that one-third of the dairy cows in this State do not pay for their keep. If these cows were disposed of the State would be readily richer in consequence. According to statistics published in the *Commonwealth Year-Book*, the average yield of milk from the cows in Victoria is 397 gallons. Even if it is assumed that the average test is 4 per cent., this means 158 lbs. of butter fat per cow. The cost of keeping a dairy cow has been variously estimated from time to time, but with the high costs of labour, feed, appliances now operating, it is doubtful whether a cow can be kept for less than £10. Hence the average cow with a production of 158 lbs. of butter fat, even with the present high prices of butter fat, barely pays expenses, and with normal prices for butter fat she would be a decided robber.

In the Colac Herd Testing Association, of the 600 cows tested 300 of them failed to reach 200 lbs., and fifteen failed to give even 100 lbs. of butter fat. If these are the actual returns from the cows in the best dairying country in the State, what may be expected from the cows on poor to average country?

Increased production per cow may be effected through the triple pathways of better feeding methods, the use of high-grade sires, and the drastic weeding out of the unprofitable "hoarder" cows by the formation of Cow Testing Associations, and an extension of the herd testing now in vogue for pure bred herds.

Diversified Agriculture.

Last year I had the opportunity of contrasting agricultural conditions in the United States with those in Australia. The two countries are very similar in many respects. They are almost identical in area. One-half of the United States has a rainfall of 20 inches or over; one-third of Australia enjoys a similar rainfall. The climatic conditions are otherwise in favour of Australia. But the impressive feature of American agriculture in contrast with our own is the extent to which it is diversified.

Wheat is our great staple crop and our export crop. The success or failure of the wheat crop to a large extent determines the financial solvency of the country. America, on the other hand, is neither a one-crop country nor a one-stock country, but is a land with great diversity in crop production, and is equally strong in live-stock production.

Maize, cotton, hay, wheat, oats, lucerne, barley, flax, sugar, tobacco, and fruit are grown over enormous areas, each type of crop being confined to the region in which it thrives best.

I would like to give you a few statistics showing the production of some of their staple crops in order to give you some idea of what a country with the same area as Australia may produce when it is fairly well on the way towards full agricultural development.

The maize crop of America amounts to 3,000,000,000 bushels. Suppose this maize were placed in 5-ton waggons and placed end to end, then the line of waggons would extend for 50,000 miles—twice round the world. The Victorian crop would extend, if put in similar trucks, from Dandenong to Melbourne, and the line of maize waggons to hold the crop of Australia would not reach to Albury.

Eighty per cent. of this stupendous quantity is fed to stock. The normal wheat crop is 900,000,000 bushels—nine times as much as the normal production of Australia. The oat crop amounts to 1,500,000,000 bushels—one hundred times our Australian production. The hay crop is immense. Last year it exceeded 85,000,000 tons. To visualize this hay, imagine a stack 7 yards wide and 7 yards high stretching from here to London. That would be 12,000 miles long. Such a stack would just accommodate the American crop. A stack from Melbourne to Adelaide would hold the Australian crop.

The cotton crop amounted to 16,000,000 bales. Cotton is one of the competitors with Australian wool. The American farmers plucked by hand from the heads of the cotton plants an amount of cotton ten times as great as the entire wool clip of Australia.

In addition to this, 5,000,000 acres are sown to lucerne. The fruit crop of California alone is over 1,000,000 acres. Then from sugar beet 870,000 tons of sugar were produced.

Besides this immense production of crops they maintain nearly five times as many stock as we do in the whole of Australia—60,000,000 cattle, 70,000,000 pigs, 25,000,000 horses, and 50,000,000 sheep.

This is what is meant by diversified agriculture. A great variety of crop products and intensive production of animals in place of a one-crop *régime*. This is the direction in which Victorian agriculture must inevitably develop, for here lands are practically all settled, and increased production must come from intensive production rather than from multiplication of acreage under crop.

Now let us consider a few instances where developments may take place in Victoria.

The Stock Industry.

The total number of live stock in Victoria has not materially increased during the past twenty-five years, and as long as we rely almost exclusively on grazing it is not likely that the numbers will grow very much.

There are three avenues along which development may take place, all of which will aid Victoria in carrying more live stock.

1. Top dressing of pasture lands.
2. The growth of forage crops.
3. Developing irrigated agriculture.

There are some 33,000,000 acres of pasture land in the State. This area supports over 80 per cent. of the sheep and cattle of the State.

Numerous experiments and practical experience have demonstrated that, in the better-rainfall districts at least, a great increase in the stock-carrying capacity of the pastures would result from the expenditure of a few shillings per acre on the application of phosphates to the soil. In the North-east, the Western District, and particularly in Gippsland, the application of a top-dressing of 1 cwt. of phosphate has caused a marked improvement in the quality and quantity of herbage.

The second method available for increasing the stock-carrying capacity of the State is to increase the area sown to forages for feeding down to stock. In Victoria, barely 50,000 acres are sown to forage crops for feeding down to sheep. In New Zealand, which carries double the number of sheep, no less than 1,000,000 acres are sown to forage crops, and 5,000,000 acres of land have been ploughed up and sown to permanent pasture. Yet, less than 40 years ago, Victoria carried more sheep than New Zealand.

The development of our irrigated lands opens up a fine prospect for increasing the stock-carrying capacity of the State, and providing an additional insurance against drought. Substantial development has taken place in irrigation. In 1902, the total storages in the State amounted to 172,000 acre-feet. The present storage amounts to 562,000 acre-feet, which provides water for 250,000 acres of irrigable land. When the existing storages are completed, the quantity of impounded water will exceed 1,000,000 acre-feet.

After years of contentious discussion, the States of New South Wales, Victoria, and South Australia, and the Federal Government have come to an agreement regarding the utilization of the Murray waters, and these Governments, acting co-operatively, propose spending £5,000,000 in providing a series of storages. What a remarkable prospect is opened up by a consideration of the possibilities of the Murray lands! The settlement at Mildura is an inspiring example of what can be done by the application of irrigation water to arid districts. Prior to the advent of irrigation, Mildura was a sheep walk, supporting at most a few families on the whole area. To-day, the 12,000 acres included in the settlement support in comfort a population of 6,000, and the annual production exceeds £600,000 in value. Settlers are prosperous, and the settlement enjoys a high standard of comfort, and reaps all the educational and social advantages of a compact and closely-knit community.

It would, perhaps, be extravagant to say that the 1,500,000 acres of irrigable land to be opened up in the Murray Valley by the construction of new storages under the Murray Waters Act, can be expected to equal Mildura in out-turn per acre, for Mildura confines itself to specialized fruits, for which there is a limited demand at current prices. But these new lands may be expected to carry immense numbers of live stock, and will be similar to many of the prosperous irrigation settlements throughout Australia.

Lucerne.

The crop which may be expected to be grown most largely will be lucerne. Lucerne has well been named the King of Fodders, and the greatest mortgage-lifter yet discovered, for if the soil conditions are suitable, there is no forage crop that can equal it in out-turn per acre. Lucerne plays a very prominent part in feeding live stock in the Argentine, and it is the universal forage for stock in Western America. No less than 5,000,000 acres have been sown in the United States to lucerne, and the greater part of this is irrigated. There are some 100,000 acres under lucerne in Victoria, the greater part of which is on the irrigated settlements. But there are many areas in Gippsland, Western District, and in the North-east, where it will thrive and give heavy yields without irrigation. On the Werribee Research Farm, we have been growing lucerne under irrigation for six years. The average yield during that

period has exceeded 5 tons per acre. At Werribee, we have demonstrated conclusively that irrigated lucerne requires to be liberally top-dressed, and renovated with culture every year in order to maintain it in full yield. It is difficult to secure more than 3½ tons of hay from the unmanured areas at Werribee, whilst the addition of 2 cwt. of superphosphate every year, combined with judicious winter renovation, has raised the average yield to 5 tons per acre.

Our investigations show that a 6-ton crop of lucerne requires as much phosphates as six 15-bushel wheat crops. No farmer attempts to raise wheat without phosphates, and for a heavy feeder like lucerne, liberal dressings of phosphate, combined with renovation, each winter are necessary to maintain heavy yields.

In new districts, such as South Gippsland, inoculation has been shown to be necessary. Lucerne grown in these parts, *e.g.*, Toora, Foster, &c., but unthriftily. When inoculated soil from Bacchus Marsh or Werribee is added, the plants thrive amazingly. This suggests that the bacteria responsible for nitrogen fixation in lucerne may be absent from some districts of the State in which the plant has not hitherto been cultivated.

Minor Crops.

Besides the development of our staples, wheat, dairying, and live stock, attention needs to be given to what might be termed minor crops. There are four worthy of special attention—flax, sugar beet, tobacco, potatoes.

Flax.—Victoria has been interested in the flax industry for many years. Prior to the war, the industry was confined to the growth of a few hundred acres in the Dromin district. During the war, the production of flax became of great importance to the Imperial Government for the manufacture of aeroplane cloth.

Prior to the war, 80 per cent. of the world's flax fibre was produced in Russia. Owing to the scarcity of fibre, and the destruction of the flax industry in Belgium and Russia, fibre became very scarce in Britain, and flax culture became profitable to farmers. The British Government has purchased the whole of the 1918 and 1919 Australian crop of flax fibre at £170 per ton.

There is no doubt that the price of linen goods will remain at a high level for many years, because the flax industry of Europe has become absolutely disorganized. There is a fine opportunity to establish this industry on a firm basis in Victoria. The value of linseed and flax products imported into Australia last year amounted to £1,890,000, and there is no doubt that the whole of the raw material could be grown in Victoria.

Flax can be grown almost to perfection in Dromin, Moe, Koo-wee-rup, and Bunyip Swamps, the Traralgon Flats, Sale, Portarlington. The crop requires the same treatment as oaten hay, and the Government has guaranteed the farmers £6 per ton for green flax for the 1919 crop.

The Commonwealth Flax Committee has asked the Government to guarantee £5 per ton for the next three years, and if the Government accepts the recommendation, it will enable a new agricultural industry to be established in the Commonwealth. Besides the fibre, flax is grown for seed purposes. In the wheat-belt of Argentina, India, Canada, and United States of America, there are millions of acres of land devoted to

flax for seed purposes. Crops being raised for seed require the same treatment as wheat, and can be harvested with a stripper or harvester.

The average yield is about 10 bushels per acre, and the seed is worth 15s. to £1 per bushel at the present moment. The imports of linseed into Australia are valued at £500,000 per annum. There is no reason why the linseed required for Australia should not be raised in Victoria.

Sugar-beet.—Another minor industry which gives great promise is sugar-beet. It so happens that the only sugar-beet factory in Australia is located in one of the driest belts of territory in Gippsland.

In European countries, and America, sugar-beet is one of the most profitable crops that can be grown. Its culture has revolutionized agriculture wherever it is introduced, and raises the production of all crops grown in rotation with it.

In America, the sugar-beet industry has made tremendous strides. In one district of Northern Colorado which I visited, a company was formed in 1901. In that year, 739 farmers grew sugar-beets for the company. In 1915, there were 5,456 farmers growing beet for the company. It is evident that the direct and indirect benefits to these farmers must be considerable, because they can produce potatoes, lucerne, and cereals to perfection, and unless the beet gave better returns than these crops, they would not continue its cultivation in increasing areas every year.

The future of the beet-sugar industry will be judged from the results obtained at Maffra. A study of the distribution of the rainfall at Maffra for the past twenty-five years shows that, in the majority of seasons, the rainfall during the growing period of the crop is insufficient to assure profitable production.

This will, however, be remedied by the provision of irrigation facilities on the Newry and Boisdale flats. Provision is being made for the erection of a large storage reservoir on the Macalister River, which will provide irrigation water for at least 10,000 acres of the richest land in Gippsland. This will enable the beet industry to be established on a sound footing, and will enable full crops of beets to be obtained every year. The Maffra factory has had many ups and downs, but, in spite of short acreages, indifferent crops, and obsolete machinery, the industry pays its way. When irrigation facilities are provided, and the limiting factor to profitable culture removed, the sugar-beet industry will become an important source of wealth to the State.

Tobacco.—Another industry which promises to become an important source of wealth is the tobacco industry. Over £1,000,000 worth of tobacco is imported into Australia every year. Tobacco will grow well in most parts of Victoria, and there is an extensive area of country in North-eastern Victoria where the soil and climate are eminently suitable for its production. For many years farmers have grown tobacco, but until recently the prices were not satisfactory. Special varieties of seed were some time since introduced from America, and experiments made in curing the leaf by a special process called flue-curing, and the results have been most satisfactory. The quality of the leaf has greatly improved, and so also has the price. One of the advantages of the flue-curing system is that the curing of the leaf may be absolutely controlled, and the tobacco treated in this way has been found much superior to that cured in open sheds.

Last year the Department of Agriculture secured over 2s. per lb. for the tobacco raised on experimental plots at Gapsted. Two acres of tobacco produced over ½ ton of cured tobacco leaf, which realized £110—a very fine return from 2 acres.

The industry has an opportunity for great expansion. The British and American companies operating here want Australian flue-cured tobacco leaf, and are prepared to pay good prices for it. They have offered, through the Board of Trade, to purchase 2,000,000 lbs. of Australian-grown flue-cured leaf for a period of three years. For the lemon-coloured cigarette leaf they are prepared to give 2s. 6d. per lb. for 250,000 lbs., and 2s. per lb. for 750,000 lbs. of bright flue-cured tobacco. These prices are highly satisfactory, and should act as an incentive to the establishment of the industry on a sound basis.

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These are a few of the directions in which Victorian Agriculture may be developed. I have not referred to political factors, which influence agriculture as a whole—transportation problems, efficient railways, good roads, liberal system of land settlement, conservation of water, opening up of new markets abroad, installation of bulk-handling for our wheat crop. These are political questions, and the farmers will shortly have an opportunity of discussing these with our masters—the politicians. The farmers have the power—and they are beginning to see it and organize for it—to direct public attention on right lines towards these important questions. They hold the key to the political citadel.

A NEW NOXIOUS WEED EXTERMINATOR.

Farmers throughout the Dominion will be interested to hear that both gorse and blackberry have at last been conquered. For some time past the Agricultural Department, as well as many well-known farmers, have been testing the claims made by the New Zealand Coal Tar Products, Limited, for their weed exterminator known as "Dominion Weed Destroyer." This new product has a deadly effect on gorse, blackberry, and Californian thistle. The Agricultural Department have carried out several experiments around Waiuku with excellent results. These experiments were carried out on gorse patches of various ages. Old plants 5 and 6 feet in height were killed in a few days, while the younger growth was apparently dead in as many hours. "Dominion Weed Destroyer" is a product of coal tar, and is something quite new for this purpose. It is simply diluted with water and sprayed on with an ordinary garden spray. It is non-poisonous to stock, and eventually acts as a fertilizer to the soil. Grass may be sown a few weeks after the spraying without any ill effects on the germination of the seed.

—*New Zealand Dairyman.*

IS CHANGE OF SEED NECESSARY IN THE CULTIVATION OF POTATOES?

By J. T. Ramsay, Potato Expert.

The changing of seed potatoes from one soil to another is a procedure which for years has supplied subject for argument amongst growers, without any definite conclusions being arrived at.

The opinions of those interested in the industry vary widely. Some growers contend that the seed for heavy land should be secured from a crop grown on light soil, and *vice versâ*.

In many districts, the consensus of opinion is that the produce of warm climates should be sown in cold districts, and *vice versâ*.

It is asserted by other growers that degeneration can be prevented and disease-resistant power enhanced by a change of seed, and so on *ad infinitum*.

None of these opinions are backed up by tangible proofs, and there is quite a lot of variation in the particular beliefs of the believers.

Growers in the southern States of United States of America show an increasing tendency to obtain their seed from the northern States, even though the expense involved is material. Terry, in his *A.B.C. of Potato Culture*, page 71, states that he would prefer northern to southern grown seed for planting in the south.

He gives no reason for this, and submits no proof of the higher efficiency of the "northern" seed, neither does he recommend nor condemn the use of "southern-grown" seed in the northern States—which would also be a change of seed.

W. P. Wright, of the Kent Horticultural Committee, England, in an article contained in the *Standard Encyclopædia of Modern Agriculture*, vol. 1, page 23, says:—"Varieties tend to deteriorate, although the process is greatly retarded by frequent change of seed." This opinion is not supported by any evidence submitted, nor is any recommendation made as to what particular or general change would be beneficial. Prof. Wright, of the West of Scotland Agricultural College, and W. Bruce, B.Sc., F.H.A.S., of the East of Scotland Agricultural College, in a joint article in the same work, vol. 10, page 24, state:—"The 'seed' by which the potato is usually propagated is not the true seed, the latter being used solely for the production of new varieties. This has been suggested as one reason why all varieties tend to degenerate rapidly if more than ordinary care be not taken in the selection of tubers. To counteract this, special attention is given to such points as the choice of variety, selection of strain, *change of seed*, and its preparation and storage."

Here, again, no recommendation is made as to what change of seed would be likely to improve production.

Heine, for years the leading German writer on potato culture, pronounced degeneration to be unavoidable and the introduction of new varieties a necessity; while Westermaier, who succeeded Heine, differed from this.

Fraser, in his book, *The Potato*, page 51, says, "It is often advised that potatoes (for seed) be obtained from another soil and from a more northern (*i.e.*, colder) latitude, if vigour and delayed maturity are desired, and from a southern (*i.e.*, warmer—he writes of U.S.A.

conditions) latitude, if earliness is sought; but, generally speaking, potatoes bred for a district do better there than elsewhere. Few European varieties are worth growing in America, and any introduction requires acclimatization and selection."

Bailey, of Cornell University, in *Cornell Bulletin* 25, page 175, lodges a criticism against the comparison of seed changed from one district to another. He believes the variation in productiveness to be due much more to the stock itself—how the plants have been grown and

A Plant Worthy of Reproduction.

handled in previous years—than to any influence of soil or latitude. He further points out the obvious fact that it would be impossible to procure seed stock from different growers which would be sufficiently uniform for comparative experimentation.

Gerard, who had probably a wider experience than almost any other investigator on the subject of potato-culture, in his *Recherches sur la Culture de la Pomme de Terre*, states:—"It is an opinion quite broadly held that varieties of potatoes cultivated in the same region are certain

to degenerate. It is a frequent thing to hear large buyers or starch manufacturers (Gerard writes of European conditions) declare that, after having imported and placed at the disposal of growers varieties of potatoes noted for their large crops, they have seen them give excellent results the first year, fall away the second year, and give results even lower than native potatoes in the third year. This is indeed true, but by no means inexplicable; the degeneration which one sees in this circumstance does not result from the natural weakening of the variety; it simply results from the entire lack of care with which the plants to be perpetuated are chosen. All the good tubers are sold to the market, and it is from the inferior, discarded tubers, that has been demanded a continuation of the qualities they cannot give. I have demonstrated practically, and have established the fact that if suitable tubers are selected for planting, and the cultivation accomplished with the needed care, the quality and the quantity of the crops will be maintained under all satisfactory conditions."

Here we have a strong note against change of seed, with some logical backing, which in the case of the advocates of change is always lacking.

These quotations show that amongst those who have written on this question there is much difference of opinion as to the necessity or otherwise of changing seed.

The opinions of the advocates of change of seed appear to be based on a belief in the inevitable senility of plant life, but they do not produce any evidence to support this theory, which is not capable of rational explanation.

Further they seem to ignore the fact that cultivated crops, *i.e.*, plants of high economic value, are cultivated under what are practically artificial conditions. That being so, it is only reasonable to understand that, when the high standard of those artificial conditions demanded for the maximum results are not maintained, owing to, say, bad farming, neglect, or climatic cause, deterioration of the particular species under cultivation must follow.

Conditions do obtain whereby a change of seed is justified. Several of such conditions are cited herewith:—

The seed may be non-productive.

It may be unsuitable for the soil in which it is grown.

It may be of a variety not desired by the buyers in the place where it is marketed.

It may be comprised of so many varieties as to render it useless for sale for seed purposes.

The crop may be grown in a climate so warm as would make it impossible, without facilities for cool storage, to carry seed over from season to season in good condition.

It will be noted that, with the exception of the last-mentioned circumstance, all other reasons for changing seed are within the control of the growers. Their control lies in the amount of care expended on the selection of suitable seed, and its storage.

My own opinion is that, given seed of a fair to good standard of prolificacy, and a district suited to the cultivation of the potato, there is no reason why a grower should ever have to import new seed stock. Change of seed is made, firstly and lastly, to secure better returns. The one reason why any parcel of seed gives better returns under the same

conditions than another is that the parcel producing greater yields has superior virility.

Virility of seed depends entirely on the treatment meted out to it in selection and storage. Selection and storage, then, are the vital points to which the grower should direct his attention.

When growers pay reasonable attention to selection of suitable seed and its storage, the superstitious beliefs in the efficacy of "change of seed" will be laid.

Supporting the contention that selection of seed is superior to merely changing, the following actual experience may be again recorded. One of the competitors in a Victorian Agricultural Society's field crop competition for potatoes went to the trouble of selecting seed for 1 acre specially for the competition. Unfortunately for him, the quantity he secured for this purpose was sufficient to plant only three-fourths of an acre, and his entry, owing to the conditions of the competition, was disqualified. At his request, the rate per acre produced on an adjoining field planted with the same seed without selection, was compared with crop on the area planted with selected seed.

The soil, manuring, and cultivation in each case was identical, the *only* difference being that one block was planted with selected seed, while the other was planted with the ordinary run of seed from the previous season's crop. The results obtained were as here given:—

Produce from selected seed	..	9 tons 9 cwt. per acre.
Produce from unselected seed	..	5 tons 18 cwt. per acre.
Increased yield due to selection	..	3 tons 11 cwt. per acre.

This illustration shows an increase of over 60 per cent. in favour of selected seed, which should impress, even if it does not convince sceptics.

Another case worthy of note is that of Mr. Kenny, manager of the Orphanage, Ballarat. Fully twenty years ago, Mr. Kenny secured a parcel of seed. Since then he has used no other. By selecting from his best plants each year, he has not only maintained the productiveness of this strain, but has improved it.

Further proof of the lack of necessity for changing seed is afforded in the following report on a test between home-grown and imported seed conducted by the Department of Technical Instruction in Agriculture for Ireland, copied from their official *Journal*, Volume XIX., part II., page 186. The report states: -

"The opinion is widely held that it is necessary to introduce a change of seed potatoes more or less frequently if the best results are to be obtained. This belief was known to be well founded in England. No data, however, regarding this matter were available for this country, and the Department decided that useful information might be collected if experiments were conducted on a uniform basis in every county in Ireland. Such tests were instituted in 1914 and repeated on exactly the same lines in 1915 and 1916.

"The experiment was designed to ascertain:—

(*a*) Whether any advantage is to be gained in Ireland by introducing a change of seed potatoes, and

(*b*) If so, whether the seed potatoes should be procured from Great Britain or from another part of Ireland.

"In order to eliminate all factors which might affect the yield other than that with which the experiment was directly concerned, seed was obtained early in 1913 from a common source in Ulster, and sent to six centres to be grown there for a number of years; each season part of the produce being returned and distributed to Agricultural Instructors for the purposes of the experiment. Unfortunately, the potatoes grown at the English centre were all disposed of at the end of 1915 (due to the war); consequently, only two years' results from English seed are available.

"The centres at which the seed was grown are as follows:—

1. Ulster—Cookstown, Co. Tyrone.
2. Munster—Clonakilty, Co. Cork.
3. Leinster—Glasnevin, Co. Dublin.
4. Connaught—Athenry, Co. Galway.
5. Scotland—Dumfries, Dumfriesshire.
6. England—St. Ives, Huntingdonshire (1913 and 1914 only).

"During each of the first two years, seed was obtained from all the six centres, and in 1916 from all the centres except England, and after being graded as uniformly as possible, was distributed to the Agricultural Instructors by whom the tests were carried out. The seed for the 1916 experiments had been grown three years at each centre, for, as already explained, the original stock was sent out by the Department in 1913. The variety was 'Up-to-Date.'

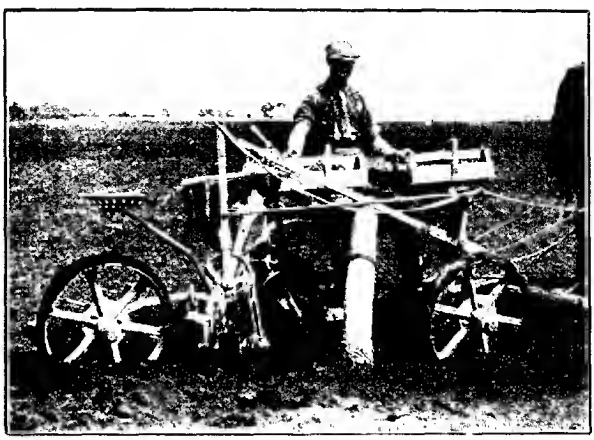
"As a basis for comparison, a plot was included on which was planted the farmers' own seed of 'Up-to-Date.'

"The results have been summarized in the briefest form in the following table:—

CHANGE OF SEED EXPERIMENT.—SUMMARY OF RESULTS.

Province.	Average Total Yield per Statute Acre.													
	Farmers' Home-grown Seed.		Seed grown in Ulster.		Seed grown in Munster.		Seed grown in Leinster.		Seed grown in Connaught.		Seed grown in Scotland.		Seed grown in England.	
	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.
Ulster (8 Centres)	10	13	10	10	9	1	9	10	10	12	9	14	-	-
Munster (8 Centres)	12	12	11	9	10	17	11	2	12	4	11	12	-	-
Leinster (8 Centres)	9	2	8	13	8	13	8	4	9	2	9	0	—	
Connaught (7 Centres)	8	15	8	10	8	3	7	17	8	18	8	17	—	
Ireland, 1916 (31 Centres)	10	6	9	17	9	4	9	4	10	5	9	16	-	-
Ireland, 1915 (38 Centres)	13	17	14	3	12	14	13	11	13	7	14	2	11	17
Ireland, 1914 (37 Centres)	13	14	13	16	13	1	14	0	13	18	14	3	13	12

"It is probable that as regards (1) the need for a change of seed potatoes and (2) the merits of one district over another in producing good seed climate is the chief determining factor. Bearing this in mind, and having regard to the varying climatic conditions which prevail in different parts of Ireland, it is not advisable to confine the analysis of the results to the general average return of all the centres. Therefore, the average returns for each province should be studied, and it may be of assistance in interpreting the results if the order of merit



Planting Machine Used by Mr. J. Gibson, Dalmore.

of the different plots as regards average total yield be shown in the following manner:—

In Ulster.—1st, Home-grown seed; 2nd, Connaught; 3rd, Ulster; 4th, Scotland; 5th, Leinster; 6th, Munster.

In Munster.—1st, Home-grown seed; 2nd, Connaught; 3rd, Scotland; 4th, Ulster; 5th, Leinster; 6th, Munster.

In Leinster.—1st and 2nd (equal), Home-grown seed and Connaught; 3rd, Scotland; 4th and 5th (equal), Ulster and Munster; 6th, Leinster.

In Connaught.—1st, Connaught; 2nd, Scotland; 3rd, Home-grown seed; 4th, Ulster; 5th, Munster; 6th, Leinster.

"The following conclusions may be drawn from the results:—(1) where sufficient attention is devoted to the selection and treatment of home-grown seed potatoes, the frequent introduction of new seed is unnecessary; (2) as good crops may be obtained from seed grown in Ireland as from imported seed."

There is but one method by which potatoes may be selected for seed so that the standard of trueness to type and yielding capacity may be maintained unimpaired, and that is, by selecting from the field crop

while the crop is green and growing, the seed intended for the following season's planting. Seed selected in this way can be chosen from the most desirable plants, *i.e.*, those plants which are healthiest, most vigorous, and producing the greatest number of marketable sized tubers. It stands to reason that seed selected from such stock must produce plants of more vigour than seed taken promiscuously from a heap where fit and unfit are mixed. At no time other than when the plants are growing can this rigorous selection of the most likely to be fit be made.

The average grower of any quantity of potatoes may be inclined to think that this care entails more trouble and cost than the crop is worth, but it is not so. For those who plant large acreages each year, and who, therefore, require many tons of seed, the work of selecting can be carried out in the following manner:—Suppose a grower plants 50 acres of potatoes yearly; that in normal seasons he gets 5 tons per acre, and that he wishes to select his seed with a view to improving his stock. At the rate of sowing of 12 cwt. per acre, it takes 30 tons to plant 50 acres. Since 6 acres of crop, at 5 tons per acre, gives 30 tons, it follows that if sufficient seed for 6 acres, viz., 3 tons 12 cwt., were rigidly selected each year, and a 6-acre area planted with them, the grower would then have a yearly stud plot producing tubers of a high standard sufficient to plant the whole of his 50 acres. The rate of planting has been, for the purpose of illustration, taken as 12 cwt. per acre, but this may vary according to the size and the spacing of the sets. Probably the rate of production of the stud plot, too, will vary, and be nearer to 10 tons, on the average, than the 5 tons mentioned in the calculation.

CURING OF LEMONS WITH VASELINE.

A Scone orchardist, anxious to keep some of a good crop of lemons for summer use, recently sought information as to the efficacy of a vaseline treatment and the comparative values of curing treatments. The Department's reply was as follows:—

The following experiments with Washington navel oranges and lemons were carried out fortnightly, commencing 14th June, 1918, and ending 7th August, 1918, at Yanco Experiment Farm:—

Fruit wrapped and packed in paper-lined cases; also in sand.

Fruit vaselined and packed in paper-lined cases; also in sand.

Fruit unwrapped and packed in paper-lined cases; also in sand.

Fruit dipped in borax and packed in paper-lined cases; also in sand.

The results from those unwrapped and those treated with borax were not satisfactory, those that had received a coating of vaseline keeping best of all. The lemons so treated kept in perfect condition from June to January, though it would not be advisable to store for market past November on account of the deterioration of the fruit beyond this month.

—*Agricultural Gazette*, N.S.W.

PEAR GROWING IN VICTORIA.

(Continued from page 595.)

By E. Wallis, Orchard Supervisor.

RAISING YOUNG PEAR TREES.

In the propagation of young pear trees, certain precautions are required, and if these be not observed the trees, in after years, will fail to give the best results. It is essential that the intending planter should, where possible, see that his young trees have been properly worked, so that when they arrive at a bearing age they may not be handicapped in their career.

In the past, the matter of parentage, both of the stock and the scion, has in many cases not received proper attention with a view to profitable pear growing; in fact, to the average planter, it has been a matter of indifference. Such apathy has probably been due in a great measure to ignorance of the importance of this aspect of propagation and its effect upon the future of the trees.

It is difficult to understand this neglect, for the principle involved—selection—has long been practically recognised, with splendid results, in the raising of both flowers and vegetables. But with the propagation of young pear trees, and, in fact, fruit trees generally, the matter of selection has been confined chiefly to the choice of varieties, no systematic attention being given to the character of the trees from which buds and grafts have been taken.

No one who has studied the question, and taken established trees as a guide, has any doubt as to the direct effect of selection of buds or grafts from trees of good bearing habit upon the career of fruit trees; and it is certain that much of the barrenness of pear trees, so often found in orchards, is due to their having been worked upon unsuitable stocks, or with buds or grafts taken from trees of unfruitful habit.

The Stock.

The stock has a direct effect upon the scion. In the case of the pear worked on the quince stock, the resultant tree is considerably dwarfed; whilst if the reverse plan be adopted of working the quince on the pear, the growth is increased. This bears out the rule that "like produces like," which is further evidenced where the pear sucker is used as a stock. Formerly, it was a common practice with propagators to work the pear on pear suckers, and even at the present time it is not totally unknown, owing, no doubt, to such stocks being so easily obtainable. Most of our nurserymen, however, having in mind the future welfare of the trees, have discontinued the practice. When this stock is used it will be found that after the tree is established the suckering habit becomes very pronounced, the entire surface of ground planted with such trees often becoming covered with sucker growths from roots interfered with during the ploughing operations. This suckering is not only detrimental from a cultural stand-point, but, worse still, is distinctly harmful to the bearing habit of the affected trees, notwithstanding the attention which may be given by scientific pruning, &c., in order to induce a fruitful condition of the trees.

In Plate No. 26, a tree of the Williams' Bon Chretien variety, grown on sucker stock, is illustrated. This tree, although about ten years old,

has at no time borne any profitable quantity of fruit, owing to the depletion of the fruit buds, due to the suckering habit. In old-established orchard districts, large numbers of similarly affected trees are usually to be found.

For the majority of troubles affecting pear trees a remedy may usually be applied, but when trees are rendered barren, or practically so, by this method of propagation, it is better not to waste valuable time in trying to overcome the trouble by scientific means, but rather to make room for trees worked in the proper way. Various other stocks have been used from time to time on which to work the pear, including the pear seedling, pear cutting, pear root-graft, whitethorn, and others.

Plate No. 26.—Pear-tree worked on suckers, with consequent suckering habit.

Raising pears from cuttings is not a satisfactory commercial proposition, as they are not readily struck in this way, and even when struck, the root system of the cutting does not make for free growth in the tree like that of the seedling. It is found, however, that cuttings taken from seedling trees strike more readily than those from trees of a worked variety, and perhaps experiments conducted along this line may produce a free-rooting stock worthy of being perpetuated.

Some growers claim to have influenced shy-bearing varieties, such as Winter Nelis, by striking cuttings from a Williams' Bon Chretien

tree, and using the roots for root-grafting the variety desired to be influenced.

Although there may be a difference of opinion as to the relative qualities of stocks used for some fruits, it is almost universally agreed that the pear seedling so far has given the best results as a stock upon which to work selected varieties of the pear. It is known as a "free" stock, and trees worked upon good specimens are generally influenced into thrifty growth.

With seedling pears, however, if the seed is obtained without discrimination as to variety, there is usually great variation in their growth and general appearance, some being clean and erect in the stem, whilst others may be thorny and otherwise undesirable from a top-grafting point of view.

As the pear seedling, generally speaking, possesses such desirable qualities in regard to its influence upon growth, non-suckering, &c., any deficiency in the other respects mentioned may be overcome.

For instance, by selecting seed from the Oriental type of pear, such as Kieffer or Garber's Hybrid, which claim part parentage from the Chinese Sand Pear, a more even class of seedling is produced, and one more thrifty in growth and cleaner in the stem. In America, where the pear blight is such a menace to the pear-growing industry, it is found that seedling stocks raised from the Oriental type are more resistant to the disease; and in Victoria we know that the several varieties of this strain are practically immune from Pear Scab, and may be classed as clean, free-growing trees.

Considering these facts, and the general effect of this stock upon the worked trees, the seed of the varieties mentioned may be recommended as highly suitable for the production of seedling stocks, and more satisfactory generally than the seed of most other kinds—certainly more so than that of mixed varieties.

The difficulty is to obtain sufficient quantities of seed for the purpose of raising seedlings. In pre-war times, large quantities of pear seed and seedlings were imported from France, America, and Japan; but as the Kieffer pear is used largely for canning purposes by jam factories, it should be possible to secure the pips from the discarded cores of the pears used in this way. If the pips were saved, it would assist to supply the local demand for pear seed for the purposes of pear-stock production, notwithstanding the fact that the fruit of the Kieffer variety does not, as a rule, produce as many pips as some other varieties, such as Broompark, the seed of which also produces a good stock, but not so generally suitable as Kieffer.

Plump, well-developed seed from good specimen fruits produces the best seedling growths. The ideal way of gathering the seed of pears is to allow the fruit to become quite ripe, or, in fact, decomposed, when the seed may be readily washed out. A state of decomposition in the fruit does not similarly affect the seed, which remains fresh and fertile, although placed in such an environment. In fact, this is nature's way of preparing the seed for its germination.

If pear seed be removed from ripe or decomposed fruit, it will be found that the covering or skin of the seed is comparatively soft, but if allowed to become dry, the skin soon becomes hard and tough, and it is this hardness which makes the germination of pear seed so pro-

tracted after its being sown in the ordinary way. It appears to the writer that if the seed, after removal from the fruit, were either sown at once or placed in some medium, such as sand or light loam, till time of sowing in late winter, germination would be greatly facilitated. If it be desired to hold the seed for future use, it should be thoroughly dried before storing, otherwise it may become mouldy, and thus rendered useless.

It is the practice in the nursery to sow the seed thickly in drills about 1 inch deep and 18 inches apart, but it may also be broadcasted with equally good results. The soil should be of a light loamy character.

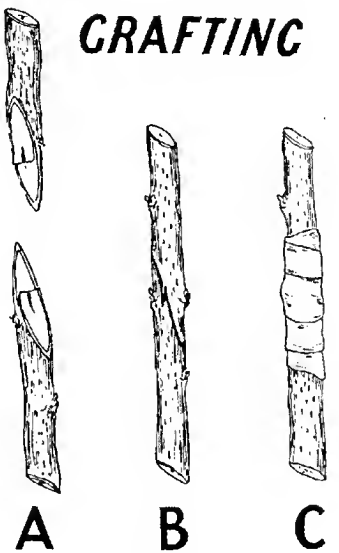


Plate No. 27.

The year following the sowing of the seed, the seedlings may be planted out in nursery rows about 9 inches to 12 inches apart, and if growth has been satisfactory, they should be budded with varieties desired during the following late summer. If stocks are weakly, they should be allowed to grow for another year before being budded, or they may be grafted in the early spring.

The Scion.

Cuttings taken from trees for use as scions should be taken from one-year old matured wood of trees known to be of good bearing habit.

As a rule, at the time of grafting, *i.e.*, early spring, the wood from previous season's growth is mostly matured, except in the case of shoots taken from centres of densely growing trees. Such immature wood must be avoided for grafting purposes. Grafting wood should be cut

from the tree in early winter and heeled in the ground in a shaded situation, so as to keep the buds in a dormant condition till the wood is used. At the time of grafting, the sap movement in the stock should be more active than that of the scion.

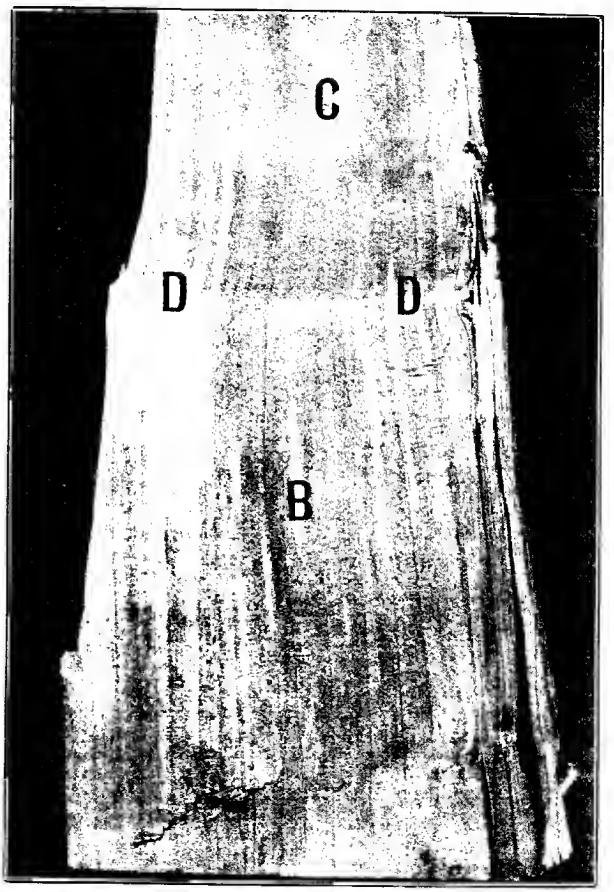


Plate 28.- Section of a pear tree originally whip-grafted. A, where graft was made; B, Stock; C, Scion; D, Line of demarcation.

Making the Union.

The method of uniting the stock and the scion in nursery work is generally done by using what is known as the whip or tongue graft. This form of grafting is recommended where the two parts to be joined

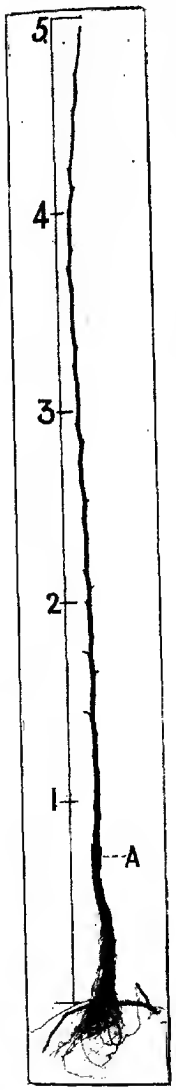


Plate 29. Rod or single-stemmed pear-tree, produced from a base graft.

are of equal or nearly equal diameter. In Plate No. 27, the details of the operation are shown. The end of the stock is cut off obliquely, and likewise the scion; they are then tongued as shown in A. Care should be taken that all cuts are cleanly made, with no ragged edges.

After the wood has been prepared in the way mentioned, the tongue in the scion is inserted gently into the corresponding cut made in the stock, care being taken that the respective barks on one side at least are placed in direct contact with each other, as shown in B. After the junction is neatly made as described, a strip of thin calico, about ½ inch wide, prepared with grafting wax, and of sufficient length to cover the cuts and exclude the air, is wrapped neatly round the graft, as seen in C; this completes the operation.

Plate No. 28 depicts part of a stem section of a pear tree about 40 years old which was originally whip-grafted, an indication of which still remains at the spot, marked A. The part B is the stock, C the scion, and D the line of demarcation between stock and scion. The annular markings, each one representing the annual growth of the tree, may be clearly seen. Unfortunately, when the writer obtained this specimen, the tree had been badly mutilated, and thus only half the diameter of the stem is shown.

As pear seedlings cannot be relied upon to grow uniformly with clean, erect stems, discrimination in the method of grafting will need to be considered. For instance, as a rule, few stocks amongst the seedlings will be found to have clean and erect stems, and this defect will preclude the propagator from top-grafting them. Any of the seedlings, however, that have the desired quality for top-grafting, may be so worked from about 12 to 18 inches from the surface of the ground, at which point the head or primary framework of the tree will develop.

The Rod or Single-stemmed Tree.

In cases where the seedlings are rough in the stem and undesirable for top-grafting, it is better to use the base-graft, or work them by budding. By adopting either of these methods, a new stem for the tree is created, and if allowed to grow unchecked, is known as a rod or single-stemmed tree. This form of tree is preferred by many growers, as it may be shortened back after planting to any height desired, and thus uniformity in the height of the stems of the trees is assured.

With the base-graft, only one good bud on the scion is required, this being sufficient to form the stem or rod; and by using this method of grafting, the smallest seedlings may, if desired, be worked.

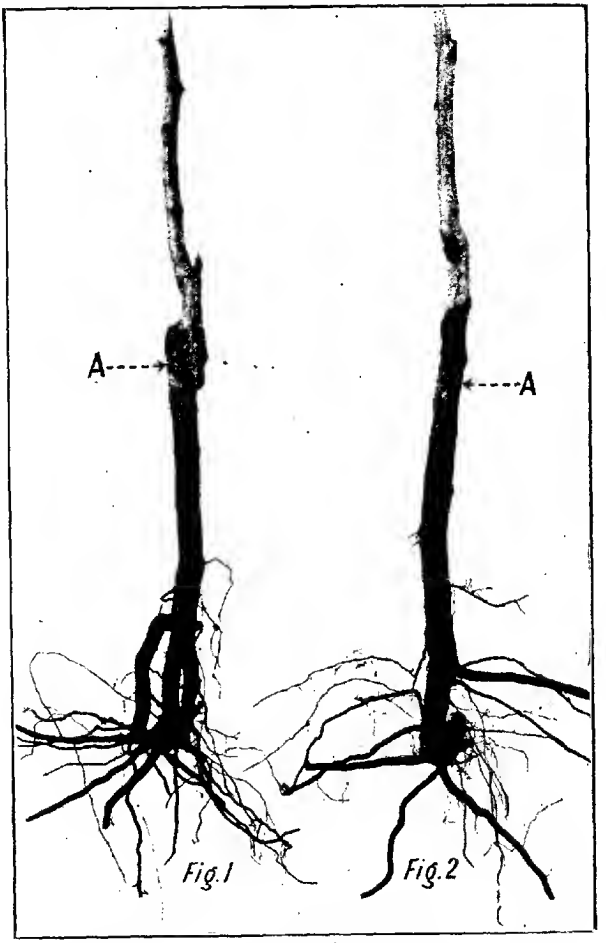


Plate 30.

Fig. 1.—Base graft with rough callus. Fig. 2.—Base graft with clean union.

Plate No. 29 illustrates a rod or single-stemmed tree produced from a base-graft. The letter A indicates where the graft was made, and the figures represent the height in feet of the young tree.

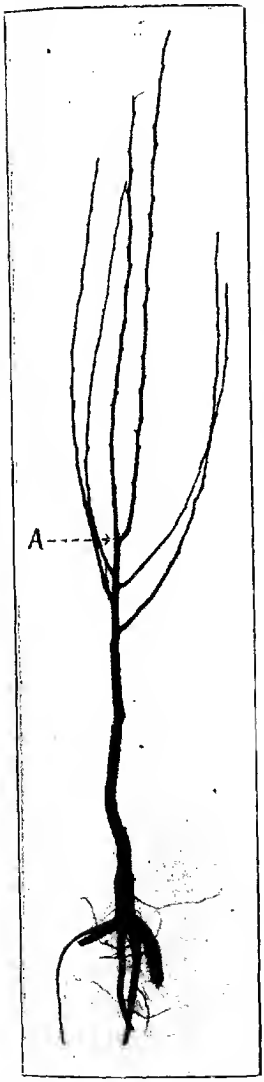


Plate 31.—Branched pear-tree as usually sent from the nursery.

In some cases, it is better to make the base-graft slightly above the surface of soil in order to insure a clean union, for, owing to the irritant action of some soils on the callus, a very rough union is made, as seen in Plate No. 30, Fig. 1, A. Fig. 2, A, shows a base-graft with a clean union.

The Branched Tree.

The branched tree may be produced either by top-grafting, base-grafting, or budding. When the method of top-grafting is employed, a scion comprising three or four buds is grafted at the height of the stem desired for the tree to branch. These buds will, under proper conditions, break away into active growth, and produce a primary framework for the tree.

If it be desired to produce a branched tree from a single-stemmed tree created by budding or base-grafting, it is necessary to pinch off, about December, the top of the young rod growing in the nursery rows. The result of this interference with the growth of the young rod is that the terminal buds are stimulated into active growth, and thus form a branched tree. Such a tree is illustrated in Plate No. 31. It will be seen by reference to this plate that the young tree was pinched back at a point marked A. As a result, the sap was concentrated in the six terminal buds, all of which shot out into active growth, as shown in the plate. At planting time, two or three of these shoots may be removed at their base, and a well-balanced head will result.

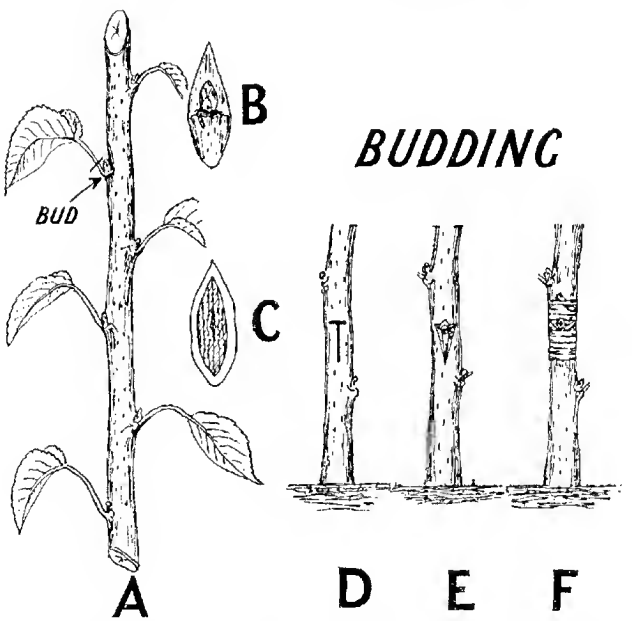
Budding.

Budding is, perhaps, the more satisfactory way of working the pear, and if the seedlings are too small for taking the bud the first season after seed is sown, it is better to allow them to remain in the nursery for another year, by which time they will have become good specimens for budding. Budding also makes a nice clean stem, and does not produce any unsightly callus, as in the case of some base-grafts.

A single robust pear bud possesses all the factors necessary for producing a pear tree in the same way as the greater number in the case of the top-graft.

The operation of budding is performed while the sap is in an active condition, while, of course, grafting is done when the sap movement is commencing in the early spring.

The selection of buds for best results is not confined only to those from good-bearing trees, but the physical quality of the buds themselves must also be considered. As the young wood from which the buds are taken is not as a rule fully matured at the time of budding, care must be exercised in choosing good, healthy buds from present season's wood. It will generally be found that the two or three buds nearest the base of the shoot



are not well developed, and these, as well as those at the terminal part of the shoot, should be discarded for budding purposes in favour of the better-matured buds usually found on the intermediate part. All flat or doubtful buds should also be rejected.

It will usually be found that the wood of established orchard trees is more matured at budding time than that of nursery trees, and for this, and the other reasons already mentioned, the former should be selected, where possible, to provide the buds.

Generally late in February, or during March, according to climatic conditions, is the best time for budding operations to be performed.

The reason for doing the work at this time is that, with the lessened sap movement of the season, the bud and the stock are simply united

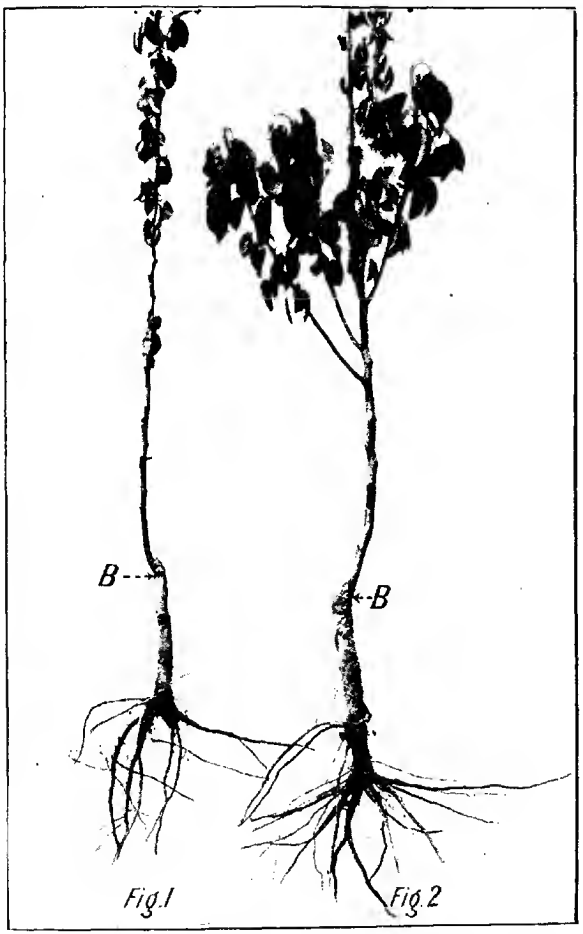


Plate 33.—Young pear trees propagated by budding.
Fig. 1.—Rod or single-stemmed pear tree. Fig. 2.—Branched tree.

and not forced into growth till the following spring. Such budding is known as the dormant bud.

When budding, it is necessary to have sufficient sap for the bud to slip into position without any undue pressure, and even a cold change in the weather at this time will be sufficient to make the conditions unfavorable for budding to be successfully performed. With the recurrence of a warm day or two, however, it will be found that the sap flow becomes stronger again, enabling the operation to be resumed.

Assuming, then, that the wood for budding has been secured, the bud for insertion in the stock is removed from the selected shoot, as depicted in Plate No. 32, A. In cutting out the bud, the cut should be made at the basal end of the bud, and at this point a thin wedge-like

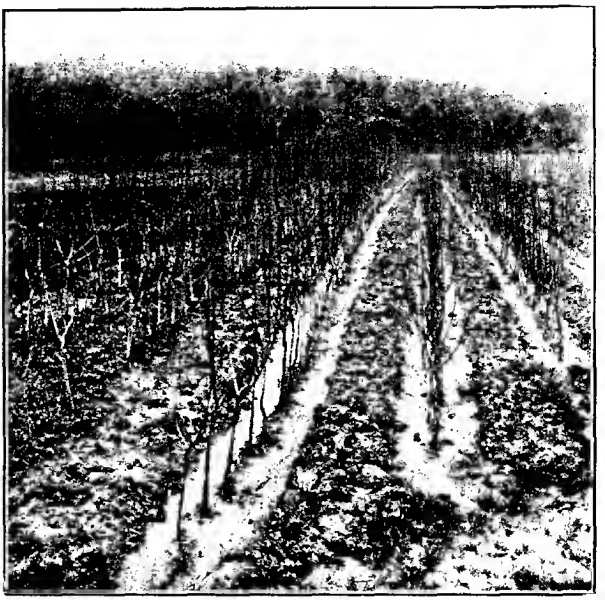


Plate 34.—Rows of young pear trees in the nursery ready for planting.

end is made, tapering off very thinly at the top, which form allows of the easy insertion of the bud into the prepared cut. A thin layer of wood is removed with the bud, and in the case of the pear bud, it is found more satisfactory to allow the wood to remain attached to the bud as shown in C. If this wood be removed, a deep cavity in the bud is exposed, making it more likely for the bud to dry out. B shows a front view of removed bud.

In order to insert the bud into the stock, a T-shaped cut is made in the stock by first making a vertical incision through the bark about

1 inch long, and a horizontal cut to form the T, as shown in D. In making the cross-cut, the knife should be forced gently in a downward direction, thus forming a slight lip, which facilitates the insertion of the bud. If the sap movement in the stock is fairly free, the bud will slip into its position without any undue pressure being used. After the insertion of the bud in the T cut as shown in E, it is tied round firmly and snugly with raffia, which is a fibre obtained from the palm. This completes the operation, as seen in F.

It is found that if buds are placed on the south side of the stock, or on the side least exposed to drying winds and sun, the success of the operation will be more assured. After the lapse of about two weeks after budding, it will usually be found necessary to cut the ties, owing to their becoming too taut, consequent on the swelling of the bark caused by the restriction of the sap movement.

In Plate No. 33 is shown two young pear trees worked by budding, Fig. 1 being a rod or single-stemmed tree, and Fig. 2 a branched tree. The letter B in each case shows where stocks were budded.

Plate No. 34 shows rows of young pear trees ready for planting out in the orchard.

The most satisfactory trees for planting, if single-stemmed trees are not used, are those of medium size, fairly short in the stem, well balanced with three or four leading shoots, fairly uniform in their development, and with a good root system.

Owing to the pear tree being naturally of an upright-growing habit, the distance from the surface of the ground to the first branch of the young trees should not exceed 15 inches. Such short-stemmed trees assist the orchardist in his subsequent work of shaping the limbs obliquely, which is quite a difficult task with high-stemmed trees.

THE SUGAR INDUSTRY.

The general superintendent of the Bureau of Sugar Experiment Stations in Queensland (Mr. H. T. Easterby), has stated that probably the estimate for the 1919 sugar crop was in the region of 155,000 tons, which was considerably lower than that formed in May. This was due largely to the long and continued drought and damage by frosts in the southern sugar districts. Fortunately the sugar content in the cane was very high, otherwise the output would have been lower. Compared with last year there would be a reduction of 35,000 tons of sugar made, and the total would be 152,714 tons less than the amount manufactured in 1917. The variations were due largely to climatic reasons, but the high prices of implements and fertilizers, and the scarcity of fertilizers during the past few years, had had a deterrent effect upon the production.

THE IMPROVEMENT OF THE DAIRY INDUSTRY.

By J. S. McFadzean, Senior Dairy Supervisor.

A general improvement in any line of agriculture necessitates much patient, as well as forceful advocacy. Throughout the whole of Victoria there is very urgent need for special effort towards improving the dairy herds. The annual loss to the State, as well as to the individual farmers, owing to the keeping of inferior dairy cattle is enormous; and the necessity for improvement should be urged at all times. The high prices ruling for farming requirements, such as manufactured foodstuffs, clothing, harness, implements, and machinery, as well as the increased cost of hired labour, are a severe tax on the farmer's income. Certainly the present high value of butter-fat assists him to meet his heavy outlay, but the balance is against him, and it is very evident that the dairying business is in serious need of an increased "per cow" production. The dairy farmer usually stocks up his grazing land to what it can carry, therefore production cannot be raised by keeping additional stock; but by culling out inferior producers and the better feeding of the good cows, there is the possibility of nearly every farmer increasing his dairy returns by fully 50 per cent.

Dairying has always been more or less profitable, but if it were only a sprofitable as it could be made, many more people would take it up, and many who now turn to the city would remain on the land. That dairying has in the past brought in a fair return is largely consequent on the favorable natural conditions. No other country has such general advantages in climate, soil, and water supply; yet nowhere is there more carelessness displayed in regard to dairy management. Not only are inferior cows kept, but hundreds of farmers do not grow any regular supply of fodder for their stock; and poor as the cattle are in dairy quality, they cannot even do their best because they are not properly fed.

There is ample evidence that the poor butter-fat returns obtained by many farmers is the result of mismanagement. There are instances all over the State of good dairy returns being obtained on farms adjacent to those where the yields are far from satisfactory; and in making a living the farmer with good cows has not to expend the same energy as those whose herds are not carefully selected. It should be the aim of every farmer to breed still better dairy stock until each member of his herd averages fully 300 lbs. of butter-fat per year. Until that standard is reached he has no reason to feel satisfied with the returns; and once having attained a 300 lbs. average he will continue to work for one still better. The apparent hesitancy amongst dairymen to begin this desired progressive movement is owing to the fact that they can and do make a living from a much lower standard of production in their herds. They somehow lack incentive to depart from the ordinary line of work and strike out for really substantial profits. The city business man will leave nothing undone to get the most from his business. He will work at his account books late in the night and early in the mornings, and he will spend large sums in advertising in order to bring in greater returns; but there are very few farmers who will use a Babcock tester after dark to see what each cow is worth to them, and to pay a reasonable price for a first-class dairy bull with which to breed better heifers is an investment that

comparatively few farmers undertake. Plain business method applied to dairy farming is all that is required to make the returns therefrom fully satisfactory. More systematic working in the early stages of building up the dairy herd would make the farmer's work much more remunerative; and his income would allow of much more pleasure and comfort than at present falls to his lot.

It is the business of every one to see that nothing preventable impedes rural production, and also that everything possible is done to assist it. That there is great room for improvement in dairy returns is seen everywhere. Inquiry made last year into the yields of a number of herds in several dairying districts showed that very few indeed of these were bringing in reasonably adequate returns from butter-fat. Frequently the butter-fat returns no more than pay for the cost of grazing the cows, and it is on the sale of pigs and calves raised on the skim milk that the small annual profit is made. Dairying tests conducted at Agricultural Shows also demonstrate what poor butter-fat producers many cows are. In one of these tests eight cows, presumably the pick of as many herds, and selected on appearance, gave less than 7 lbs. of butter-fat amongst them for the two milkings, and one of them gave only ¼ lb. of butter-fat in the day.

The results of herd-testing in the great grass-producing district of Colac has shown that about 25 per cent. of the cows tested are unprofitable as dairy stock; in other words, nearly every dairyman who is running a herd of 20 cows is grazing and milking fully five of these for no profit whatever. The contrary side to this is revealed by the dairy tests at a few shows held in districts where some of the dairy farmers have been breeding from selected dairy stock, and have tested the butter-fat producing qualities of their cows, for in those places the yields of the cows in the dairy tests are all that could be desired. Further, in the Government testing of pure-bred herds some very fine results have been obtained. For instance, out of 1,166 Jerseys tested during the past seven years, only 7.5 per cent. were below the required standard; and out of the 285 tested during last year only 6.5 per cent. were below the standard, while the average yield of the 275 Jersey cows and heifers gaining their certificates last year was 625 gallons of milk and 314 lbs. of butter-fat per head in a 273 days' test.

Before the introduction of the present system of testing pure-bred dairy cattle, many people held the belief that pure stock were not the best for dairy work; but it is certain that there are no herds of cattle in Australia, either crossbred or pure-bred, which could successfully compete with these Victorian Jerseys in butter-fat production. There are other breeds of pure-bred cattle in these tests which have also made big records, though the quality of these breeds is not so uniformly high, yet high enough to show that amongst all the pure-bred dairy cattle there are many cows far above crossbred stock in butter-producing qualities, and that every farmer desiring to improve his herd can turn to pure-bred stock with the certainty that he will be able to buy stud bulls to bring about the required result.

Where consistently big returns, such as are obtained from these pure-bred cows under the Government herd-test, are before every farmer who

reads his weekly paper, suggesting to him the necessity of herd improvement, it might be expected that a general move on this line would take place, but farmers as a rule are lamentably slow in giving up haphazard working for systematic methods, even with the sure prospect of getting much greater profit from their work.

Probably, as with the horse-breeding industry, it will eventually become necessary to legislate to prevent the use of mongrel and inferior sires. If this were done, the average annual production of dairy herds would show immediate improvement. Almost every dairy farmer is fully aware that it is possible to increase the butter-fat production of the average dairy herd by breeding from better dairy stock. They all know that heifers sired by a bull which comes of a good dairy family, and which is of good dairy type, will become profitable cows if properly fed. Most farmers know that an acre of ground properly cultivated and cropped will more than keep a cow well fed all the year through. The difficulty is to bring the majority of them to apply their knowledge so as to get the desired results of increased profits.

Should drought, floods, or fire devastate the farm, the assistance of the Government is at once sought to provide fodder, or to replace the stock lost; yet departmental advice on how to guard against such losses by proper fodder conservation in times of plenty is given little heed to, and in the selection of dairy stock the farmer usually claims to have faultless judgment. While the welfare of individual dairy farmers is primarily their own concern, their success has direct bearing on the butter factories, local markets, railways, and the State generally. Increased State production is the result of increased individual production, and consequently it is with the individual producers that the State's progress rests. Better agricultural production, therefore, is, or should be, the concern of every one, for all are more or less dependent thereon; and certainly the earning and consequent purchasing ability of dairy farmers is of direct importance to all who have business with them.

In the endeavour to encourage dairy farmers to so plan their work that they will get better returns from capital invested and labour expended, the Department of Agriculture has for years past been giving lectures on matters connected with dairying, but the results have been far from satisfactory. There is always some little good resulting from these departmental efforts, but not by any means as much as might be expected; and it would appear that in order to make the results more generally effective it will be necessary to enlist the services of those whom the welfare of the dairy farmer more directly concerns, viz., the business people of each dairying centre. Where agriculture is prospering the business population of the nearest town participate in the prosperity; and if by organized effort of the townspeople the farming community can be in any way assisted, such assistance will be well repaid in increased business.

In every centre of any agricultural importance there are societies established for the express purpose of increasing rural production; but the offering of prizes at an annual show is the main line of their working. Lectures on various subjects by departmental officers are arranged, and occasional cropping or cultivation contests are more or less regularly carried out by agricultural societies; and it would appear that if herd-testing is to become general and made successful, it will be

by the aid of these societies, or through associations formed on similar lines amongst the business people in each dairying centre.

Colac has set the example in thus forming and carrying on a herd-testing association; and that this is being run on right lines is shown by the widespread interest being taken in the work. Not only is there great interest shown in the herd-test by local residents, but there have already been some eighteen inquiries from districts all over the State in regard to the working of these tests. This shows the movement is growing, for it can be said to their credit that very few inquiries, prompted by mere curiosity, will be found emanating from any rural community. "No inquiry, no interest," is usually the rule.

This Colac association has now been in existence three years, and has gained in popularity meanwhile. Its working system is simple in the extreme. The cash cost to the dairy farmer is, for a 40-cow herd, about 25s. for the outfit of scales and bottles, and an annual subscription of 2s. 9d. per cow to cover cost of testing and secretarial work. Each member of the association takes his own samples on one regular day—two milkings—in each month, and the samples are carried free to the factory where the testing is done. The testing officer of the association, who is paid £200 a year for his services, is provided with a room, steam, and other working conveniences by the Colac Dairy Company in its factory premises; and from there all the returns are forwarded to the farmers as soon as made up. All necessary printing and stationery are provided by the Department of Agriculture free of cost. One specific instance of the value of this work is contained in a report showing that a herd of 60 cows has been culled down now to 45 head, yet the owner this past year obtained 1,500 lbs. of butter-fat more than formerly, and besides has been saved the labour of dealing with the fifteen unprofitable cows. "Better cattle, better feed," should be the motto of every dairying community. Systematic fodder-growing, herd-testing, stud bull selection, and economic feeding of dairy cattle will enable nearly every dairy farmer in the State to considerably increase his income. Departmental advice and instruction on all these matters are available where required, and all that is needed is the interested local effort. Properly organized dairy improvement associations is the great need in the dairying districts throughout Victoria, and their formation would soon bring about definite advancement in farm profits.

There has been a sudden and unprecedented incursion of flying-foxes into the Albion Park (N.S.W.) district, the bats having taken up their abode in a deep gorge at Croome, known as "Foxes Gully." The foxes are so ravenous that they are devouring half-grown peaches. The local residents are banding themselves together to deal with the foxes in their haunts, where they hang from the branches of the trees in the daytime. An application has been made to the Government for a supply of ammunition to enable the gunmen to attack the pest before the orchards are ruined. The early appearance of the flying-foxes is said to be due to the dryness of the weather inland, which has forced them coastwards in search of food.

MANURES AND FERTILIZERS FOR TOBACCO.

By Temple A. J. Smith, Tobacco Expert.

Tobacco is not an exhaustive crop, compared with such products as wheat, oats, potatoes, &c. As a general rule, fertilizers are not applied, but there can be no doubt certain forms should be used, as the tobacco plant, though not a gross feeder, takes its requirements from the soil in a short growing period of from twelve to twenty weeks, and the quicker the plants grow the better the quality of the tobacco, and at the same time less working of the land and attention to the crop is required. Consequently, the up-to-date grower should see that the land is well supplied with a liberal supply of the necessary plant foods.

A yield of tobacco totalling 1,875 lbs. weight of cured leaves and stalks, which is a fairly large average return, takes from an acre the following amounts of the chief plant foods:—

Nitrogen	65 lbs.
Potash	89 lbs.
Phosphoric Acid	8 lbs.

It will be seen from these figures that tobacco requires a large amount of potash, a lesser quantity of nitrogen, and a small quantity of phosphoric acid.

Nearly all Victorian soils are well supplied naturally with potash, and nitrogen can be obtained in sufficient quantities by fallowing and good cultivation. In most cases lime and phosphoric acid are the two chief wants in most cases, and where lime is deficient, applications of sulphate of lime, "gypsum," or ground limestone, in quantities ranging from 5 cwt. per acre, to 2 tons per acre, will be found beneficial. The effect of fairly large applications of lime will be to sweeten an acid soil, destroy the larvæ of insects, release potash already in the soil, and increase nitrification, thus ensuring a greater supply of nitrogen. Lime will also improve the mechanical condition of the soil. One application of lime will show results in the soil over a period of from six years to ten years, or more, according to the quantity used.

Nitrogen has the effect of stimulating the growth of the crop, and the production of a larger and heavier yield. Too much nitrogen, however, is liable to encourage a coarse tobacco leaf, with a heavy nicotine content, which is not desirable in the lighter tobaccoes. Where nitrogen is required, red blood gives best results. Potash gives quality to the tobacco, and improves its burning powers. Care should always be taken to use only high-grade potash fertilizers—sulphate of potash being the best—as the low-grade potash fertilizers, such as Kainit and chloride of potash, have a detrimental effect on the burning of the leaf. One to 2 cwt. of sulphate of potash is a good dressing. Phosphoric acid has the effect of assisting the early growth of the crop, and maintaining its health, and hastening maturity, an important matter with the tobacco crop, as every week that tobacco is unnecessarily in the field means more work in attention to suckers, and greater risk in loss from frost, hail, or other troubles.

Superphosphates supply phosphoric acid in the most available form, and applications of from 1 to 2 cwt. per acre will be of great value in ensuring a crop and lessening the growing period by two to three weeks.

For rich soils, no manure is required for the first crop, but later on, as more crops are taken off, superphosphates should be used.

Ordinary farm manures cause a heavy growth of coarse leaf, which is undesirable, especially as the demand at present is almost altogether for the lighter types of tobacco leaf; but where light and sandy soils are being used, well-rotted farm manure will be found very beneficial in supplying both humus and food supply.

Time to Transplant.

Transplanting season may be approximately stated as from the 1st of October to the 15th of January, and it is wise to put the plants out as soon as they are ready, that is, when the leaves are from 2 to 3 inches in length. The cautious grower will have relays of plants coming on to cover the risk of a failure of those just planted, which may occur through cut-worm, frost, or other causes. Very early planting is not always desirable, as if a cold change takes place after planting the young plants do not thrive, and growth is at a stand-still. This is a condition to be avoided at all costs, as continuous growth is essential to a healthy crop; moreover, the longer period of growth tends to greater loss and labour, as well as giving greater chances for the appearance of cut-worms and weeds. Experience has proved that November and December are the best months for transplanting, and many good and cheaply grown crops have been put out up to the end of January. In all cases, but particularly for late planting, thorough cultivation is essential. Fallowed land, well and consistently worked to make a good seed-bed and conserve moisture, will also get rid of insect pests and release greater supplies of plant food, besides saving much work in weeding and later inter-cultivation.

Distances to Plant.

The usual distance to plant is 3 feet each way, but insufficient attention is given to this important work. Where the soil is rich, and the crop is liable to grow too strong and coarse, closer planting in the rows will be found to counteract these defects. Three feet between the rows has been found the most desirable distance, as it enables a horse to work between the plants with the least damage to the crop; but when it is desired to produce a finer texture in the leaf and ripen the crop earlier, 2 feet, and even 18 inches, will be found advisable. Cigar leaf, which should be thin in texture and delicate in flavour, is especially suited to close planting in the rows. Deep planting is better than shallow, and the plant should be set to a depth that will leave the heart level with the surface, and the leaves closed to cover the heart from the direct rays of the sun. Here, again, the advantage of thorough cultivation will be observed.

In all cases where possible, the use of a tobacco transplanting machine will be found to do the work better and easier than hand planting. Two to 3 acres per day can be set out, and the plants watered at the same time, and if required manured; though broadcast manuring a couple of weeks before transplanting will be found more efficacious in the end.

Transplanting machines were a few years ago imported from America, but are now manufactured in Wangaratta, by Mr. Albert Smith, for a cost of £22 10s. per machine.

EGG PULP AND COOL STORAGE.

By A. V. D. Rintoul, Assistant Poultry Expert.

The future expansion of the poultry industry, not only in Victoria, but right through the Commonwealth of Australia, must depend, to a large extent, upon either an enormous increase in the population, or else an export trade, or both the foregoing conditions. There can be no question that eggs in the shell would fetch the highest price, but, at the same time, this is the most expensive method of exporting, and further, they would have to be shipped in a chamber by themselves at a special temperature of about 32° to 34° Fahr. Cheese, fruit, and other products would impart a flavour to the eggs, consequently a special chamber would have to be reserved, and for some years to come, should such chamber space be made available, there would undoubtedly at times be difficulty in making full and regular use of it.

Egg pulp must therefore form the basis of successful export, and it is by no means too early for the breeders to get together to consider the pooling of their supplies, and to make the necessary arrangements for marketing their produce overseas next year. Great Britain presents virtually an unlimited market with annual importations averaging fully £12,000,000 per annum. Besides having an almost unrivalled climate, we possess the additional advantage that our eggs at their time of plenty, and when in their best condition, can be exported to arrive overseas when eggs are scarce there, and so fetch the highest prices. Frozen tins of pulp may be shipped with meat, rabbits, &c., in small or large quantities without requiring a special chamber to themselves.

The supervision which the Department of Agriculture has exercised over the export of rabbits has resulted in noteworthy success, banks readily advance money against shipment, insurance companies quote the lowest possible rates, and the produce is eagerly sought in the London market, whilst further distinction was achieved by the award of gold medal for Victorian frozen rabbits and poultry at the International Exhibition at San Francisco. Rabbits, however, are a pest, and extermination is most desirable, consequently if their export is effected on such careful and systematic lines, it is of supreme importance that the utmost care be taken in relation to the export of eggs. Mr. M. K. Jenkins, Assistant Bacteriologist, and other experts of the United States Department of Agriculture, have for a number of years very carefully studied the preservation of eggs, and much of their work has been published in United States Bulletins 224, 391, and 775, in which elaborate details are given regarding causes of failure, and methods to secure best results, amongst which are the following:—

1. Hands and uniform must be kept clean.

2. Do not use any apparatus coming in contact with eggs unless it has previously been both washed and sterilized.

3. *Breaking the Eggs.*—Grasp the egg with the thumb, first and second fingers of the right hand. Give the egg a quick blow on the sharp point of the knife with sufficient force to make an even cut just through the shell and its membrane. Quickly turn the crack upwards so there will be no leakage from the egg while it is being transferred

from the knife to the cup. With the first and second fingers on the ends of the egg, use the tips of the thumbs to pull the halves of the shell apart. To empty the shell, turn each half directly upside down so that they do not touch each other, and drain for about three seconds. Do not let the cups touch the knife.

4. *When Separating White from Yolk* have three cups on the tray. Put two on the side which gets the best light, far enough back to be able to crack the eggs on the knife well beyond the cups. Put the other cup on the other side of the tray behind the breaking place on the knife. Put the white into the first cup, the yolk into the second—the other cup on the opposite side is for soft or doubtful eggs. Never separate dirty eggs by the shell method.

5. *Drying Fingers.*—Only the tips of the fingers should touch the eggs. They should be dried frequently on tissue paper.

6. Use two cups, and unless bad eggs are prevalent, put two and no more into each cup before emptying.

7. *Smell* and look at every cup of eggs carefully before emptying.

8. *When emptying cups,* pour out eggs, then touch edge of cup against inside of tin at least 2 inches below the rim. Do not therefore fill the tins too full.

9. *Eggs to be Discarded.* Musty, mouldy, and sour eggs, eggs with bloodys or green white mixed rots, eggs with a stuck yolk, white rots, and eggs with a bad odour.

10. *Cleaning after a Bad Egg.*—Remove all pieces of apparatus with which the egg has come in contact, and wash the hands before getting clean equipment. For instance, if the infected egg has reached the cup, a recently sterilized knife and cup will be required, or if the egg spattered on the tray, the entire outfit will have to be replaced. When a bad egg is present in the cup with the good ones, all must be thrown away. Spooning or pouring out what can be seen of a bad egg is not allowed.

11. Have cups, knives, trays, and collecting buckets washed and sterilized at noon and again at night.

12. Never break eggs while the room is being swept, or for one hour afterwards.

There are virtually three styles of pulp, (*a*) the Whole Egg, (*b*) Whites only, (*c*) Yolks only, and packing should be undertaken in accordance with actual market returns. The breaking room should be as near as possible to the freezing chamber, to prevent deterioration and admission of bacteria, and the more frequently eggs are consigned, and the more sanitary conditions under which they are produced, are important factors in determining the condition in which the pulp will eventually be opened up. It is, of course, preferable that all eggs should be candled before being handed over to the breakers, though this will not, by any means, automatically remove all the eggs unsuitable for pulp. By proper care the organisms of the *coli* group may be almost eliminated, and careful grading in the candling room saves considerable loss of time in the breaking room due to changing soiled apparatus.

washing hands, &c. There is always, however, a tendency in commercial houses for both the candlers and breakers to keep the records of losses as low as possible, and after rejecting a certain number of eggs, to pass some that really should be discarded. This emphasizes the necessity for the strictest possible supervision on the part of the officer in charge, in order to maintain the highest possible standard of purity.

In hot weather there is always a larger number of lower-grade eggs, containing a considerable number of broken yolks, whilst the vitelline membranes are often so weak that the white cannot be separated from the yolk, and so cannot be packed separately. For the highest class of export trade, therefore, only the best spring eggs should be used.

Attention must be paid in equipping a plant to the height of breaking stands, tables, and stools, in order to make the work as comfortable as possible, so as to secure the maximum output. In an American packing-house, where fifty-two girls were employed, the following equipment was supplied:—Four thousand three hundred and twenty linen towels, 6 inches square, for wiping hands after washing, and for drying fingers during eggbreaking. (Each towel was used once and then laundered.) Breaking knives, 134; cups, 379; trays, 61; egg separators, 97; aluminium spoons, 57.

The Rejection of Eggs During Grading.

The sense of smell plays an important part in the grading of breaking stock, as is shown by the fact that approximately half the rejected eggs in a commercial plant were eliminated on account of a bad odour. Of these about half were of musty odour, and the other half had bad odours of various kinds, which were attributable to a number of causes. Eggs stored temporarily in the same room as fruit absorb the odours of these fruits. Eggs with the odour of kerosene are not uncommon, as kerosene is sometimes used for vermin spray in fowl sheds, whilst at times nest eggs containing naphthalene may cause trouble. Sour eggs are contaminated with organisms of the B. Coli group. Care should be exercised in grading eggs with abnormal odours. All eggs, even though they appear sound, should be smelled carefully, and if any doubt as to whether the odour is due to absorption or spoilage, the questionable egg is discarded. Musty eggs have a characteristic odour and taste. In some cases the odour resembles that of old fillers; in others, that of certain weeds, or spoiling hay or chaff. As its condition can not be seen by the candle, a musty egg must be detected by its odour out of the shell. This odour is not always expelled by cooking. The possible presence of such an egg, and the unfortunate results, which are likely to occur if it is present in cake, make egg breakers realize that eggs must be graded out of the shell as well as by candle.

Egg handlers frequently do not distinguish between mouldy and musty eggs, although the two are different. The mouldy egg is caused by the growth of moulds in the egg substance, and has an odour characteristic of damp cellars. The musty egg usually is normal in appearance, and frequently resembles a perfectly fresh egg. Occasionally, however, a musty egg, with a green white, is encountered. Most musty

eggs are fairly sterile, very few containing bacteria. The ammoniacal nitrogen found in musty eggs is not excessive.

The cause of mustiness in eggs is unknown. The theory advanced by the trade is that it is due to absorption from surrounding materials. If, however, this is the case, it is difficult to explain why it does not become weaker as the egg ages in the shell in the frozen state; also why the odour in cakes does not always disappear in baking. Other types of odours do not remain with such persistence. The cause of musty eggs is still unknown.

Soft Eggs.—These represent a transition stage between edible and inedible eggs. If the yolk breaks, or is found to be broken when the egg is opened, it is necessary to determine whether or not it is fit for food. An egg with simply a ruptured vitelline membrane is not rejected, but if other signs of deterioration, such as whitish streaks in the yolk, or a muddy white, are present, it is not considered edible. Sometimes it is found that the yolk of an egg appears very weak before the candle, and, on breaking, its outline is practically lost because the yolk material has so quickly intermingled with the white. This type of egg is known in the trade as a "running egg," and is discarded. The soft eggs with the whitish streaks in the yolk, and the "running eggs," very closely approximate the degree of physical deterioration found in mixed rots. Soft eggs sometimes have a sour odour, in which case they are heavily infected with bacteria. The guiding principle to be followed in the grading of soft eggs is to reject every egg that has an odour, or a yolk which shows any signs of deterioration other than the rupture of the vitelline membrane.

White and Mixed Rots.

The eggs with white and mixed rots, or eggs with the yolk partially or entirely mixed with the white are advanced forms of the soft egg. These eggs are generally recognisable before the candle.

Cool Storage of Eggs in the Shell.

According to the United States Bureau of Markets 6,595,850 cases of 360 eggs, valued at $70,487,212 were stored during 1917-18; which, at present rates of exchange, represents over £15,000,000 worth. A careful investigation was carried out by Mr. M. K. Jenkins, Assistant Bacteriologist, on the following lines:—

(1) The relative keeping quality of fresh, heated, sound, dirty and cracked eggs.

(2) The relation of the month of storage to preservation.

(3) Efficiency of the commercial grading of eggs for cold storage.

(4) Analysis of bad eggs developing in commercially-packed eggs during storage.

(5) Relation of care in initial grading to the development of bad eggs during storage.

(6) Rate of evaporation of moisture from eggs.

(7) Rate of absorption of moisture by case and fillers.

(8) Physical and chemical changes in eggs during storage.

(9) Absorption of foreign flavours during storage.

Plan of Investigation.

The eggs used were produced in the middle west corn belts, and shipped east in refrigerator cars, taking from three days to seven days *en route*. As soon as received, they were transferred to a commission house equipped with chill rooms, a candling and a breaking room, all of which were refrigerated. The examination of the different classes of eggs to determine the relative deterioration consisted in determining the quality of the eggs in the shell by candling, and out of the shell by appearance, odour, and chemical analysis. The method of separating the edible and inedible eggs by candling and breaking was the same as that followed commercially in up-to-date candling and breaking rooms. The inedible eggs detected by candling correspond to those found by the dealers in grading eggs for market, and the bad eggs detected by breaking represent those that would be found when the eggs were opened by the consumer. The eggs were stored at a temperature of from 30° to 33° Fahr.

Results of the Investigation.

The loss in commercial fresh eggs with clean, sound shells was found to be negligible during a period of eleven months. The principal types of bad eggs found were green whites, crusted yolks, mouldy eggs, mixed rots, and white rots. The first two types are characteristic of washed eggs, after storing. Unfortunately it is not possible to detect all washed eggs by inspection of the shell before storing. If the shell of a fresh egg is dirty, its liability to spoil during holding in cool storage is markedly increased. Among commercial dirty eggs are found some soiled with faeces, mud, and blood, as well as stained eggs showing evidence of having been washed, or having come in contact with the wet, muddy feet of hens or wet nests. Bacteria and moulds can penetrate wet shells *even though unbroken*, and cause the egg to rot. It is generally recognised that eggs, with damaged shells, will not keep in storage. The most common form of deterioration of the cracked egg is through mould, and where the shells are dirty, as well as cracked, the losses are very heavy. Only eggs with clean, sound shells should ever be stored.

Relation of Quality to Preservation.

The initial quality of the eggs influences, to a large extent, their preservation by cold storage. It does not follow, however, that, because many of the eggs marketed in the summer months are shrunken and heated and do not keep well in storage, the eggs as laid by the hen in summer are not initially as good in quality as those laid in the spring. If summer eggs are delivered to store within forty-eight hours of being laid there is a negligible loss. The bad eggs show a slight breaking down of the yolk. Eggs with green whites, or crusted yolks, are rarely found amongst summer eggs, because the natural condition of the shell is

not disturbed through soiling, washing, or contact with damp surroundings. Only the best eggs should be used for storing, and new cases with new fillers are desirable.

Relation of Month to Storage.

The best results have been obtained from early spring eggs, which is accounted for by the fact that almost all the spring eggs are fresh, not shrunken, and have not been exposed to high temperatures before storing. Under-grade eggs, those which are dirty, small, shrunken, or heated, should be marketed at once in the shell. The number of bad eggs found by candling amongst first-grade spring eggs averaged about one per case, as compared with six per case in summer-packed, first-grade eggs. The presence of dirty eggs is attributed directly to oversight or carelessness in the initial sorting of the eggs for storage.

Shrinkage of Eggs, and Absorption of Moisture by Case and Fillers.

The changes in weight of eggs, case, and fillers were investigated by Mr. Jenkins in three different storage rooms. All weighing was done in the room where the eggs were held, as it was found that the cases and fillers frequently gained in weight if removed to a higher temperature. A sensitive scale was used. First the gross weight was found, then the eggs were transferred to a second case, and the fillers and the case weighed. After weighing, the eggs were returned to the original case and fillers, so that the periodical weighings were made on the same cases, fillers, and eggs. In about nine months there was an increase in weight of 9.32 per cent. for the fillers and flats, and 4 per cent. for the cases, due to absorption of moisture, against a shrinkage in weight of the eggs of about 5 per cent. Most of the moisture absorbed by the cases and fillers came from the water evaporating from the eggs.

Physical and Chemical Changes in Eggs During Cold Storage.

During the commercial holding of eggs in cold storage the air space increases in size because of the evaporation of moisture; the white becomes thinner, and eventually loses its opalescence. After six or seven months the white usually develops a yellowish tinge. The slightly yellow colour does not destroy the beating quality of the white, nor the porcelain white colour of the resulting froth. The yolk membrane weakens slowly, but if the eggs are fresh on storing, most of them can be separated even after storage for eleven months. If the physical condition of the egg is weakened through its being stale, or heated, or both, separation is difficult after it has been held in storage for only a few months. The amount of ammoniacal nitrogen in eggs graded as edible by candling and breaking was found to rise from 0.0016 to 0.0036 per cent. after seven months' storage

Absorption of Foreign Flavours During Storage.

A slight flavour is noticed in cool storage eggs when soft boiled or poached. The flavour is not so marked in the white as in the yolk (which contains a large percentage of fat). When closed, the storage room itself has some odour.

THE IMPORTANCE OF LIME IN AGRICULTURE.

By Temple A. J. Smith, Tobacco Expert.

One of the most important factors required to make a success of agricultural pursuits by soldier settlers and others is a plentiful supply of cheap lime. There is abundant evidence that such is the case, and as many of the returned men are taking up small holdings of from 5 to 20 acres for market gardening and intense farming, steps should be taken to insure an ample supply of lime at as cheap a cost as possible.

The majority of these small holdings are situated near the city, and consist of sandy soils naturally deficient in this important element. No soil is complete without a fair percentage of available lime, and it is almost impossible for any soil devoted to intense culture to contain too much.

To keep a soil sweet and in proper condition to produce leguminous and other crops to the fullest advantage, lime should be used in quantities of from half a ton to 5 tons per acre, and such applications would very often mean the difference between success and failure. It is not intended to suggest that lime only is required, but it is certainly one of the first treatments any soil should receive, where such soil is known to be wanting in this particular element.

The effects of liming are many and various, and are not as fully realized as should be the case.

Liming neutralizes acid in the soil, and makes it more alkaline, reducing the amount of sorrel and greatly increasing the growth of pease, beans, lucerne, and all other crops. It causes nitrification to a greater extent, thus providing more nitrogen—one of the most necessary plant foods—for the crop's benefit. In addition, liming sets free the otherwise locked up potash in the soil, and so allows the crop the use of another important plant food that might without liming be unused. Applications of lime kill the larvæ of insects, and so save much loss to market gardeners in time and material.

Soil temperatures are raised where lime is applied, and quicker growth naturally follows. The quality of both green feed and vegetables is better where there is sufficient lime available, and provided fertilizers are used in proper quantities, the soil will go on producing for a longer period. The mechanical effect of lime is also valuable, as it renders a clay soil more friable by drawing together the smaller particles, so making the land more easily worked; in a sandy soil it has the opposite effect, closing it and making it hold moisture better. Lime in itself has an affinity for moisture, and its presence enables the soil to retain moisture longer and to a greater extent.

There are three kinds of lime on the market, all of which are more costly to the farmer than they should be. One is burnt lime—limestone from which the moisture has been expelled by heat. This form of lime is valuable for swamp lands, especially those containing large amounts of undecomposed vegetable matter, which it assists in breaking down, and thus renders such soils useable much earlier than if left to

time and nature. Burnt lime is liable to deteriorate, as it absorbs water from the atmosphere, and for these reasons should be obtained fresh from the limeworks and applied as soon as possible. It should be ground fine for preference when it can be applied more easily and evenly than in the lump. To apply burnt lime to soils already poor in humus (decaying vegetable matter) is a mistake, as it is liable to burn and destroy this valuable constituent.

Ground limestone is the unburned limestone simply ground fine, and though not as powerful as the burned lime, is safer and more easily applied to most soils. In order to obtain the same amount of actual lime per acre, twice the quantity should be applied as compared with burnt lime. It is about half the price, consequently the freight and spreading are the only two disadvantages. It is slower in its action than burned lime, but is much easier to handle and spread.

Gypsum, or sulphate of lime, is found in natural deposits in very large quantities, and where easily procurable, pays well for distribution upon the soil and grass lands. It takes two and seven-tenths, or roughly three times as much gypsum to give the same effect as burned lime. There are enormous deposits of this form of lime at Lake Boga, and in other parts of the State, but railway freights are too high to allow of its being used in places where its great value would be felt.

There are almost unlimited deposits of limestone in the Northern, North-eastern, Western, and Gippsland Districts, which, if properly handled and distributed, would really be huge sources of national wealth. The cost of quarrying and grinding the stone should not exceed 5s. 6d. per ton, and if it could be obtained throughout the State at anything like this price, there is no doubt that its value would soon become known, and what is now but idle wealth would be helping to increase our primary production.

FARM NOTES FOR OCTOBER, 1919.

STATE RESEARCH FARM, WERRIBEE.

By H. C. Wilson, Manager.

The Season.—The end of the present month brings us to the brink of harvest, and the crops throughout the district are light.

The dry winter and spring experienced this year has shown very clearly the great necessity for carefully fallowing the land as a preparation for hay or grain crops. During the month 140 points of rain have been recorded, 90 points of which fell on 21st and 22nd October, and this timely fall insured the season's harvest.

It is estimated that from 25 to 30 cwt. per acre will be cut from 300 acres of wheat and oats sown for hay on fallow.

The rainfall for the year to date is as follows:—

	Points.
January	55
February	288
March	536
April	76
May	146
June	119
July	134
August	67
September	91
October	140
Total	1,652

The total rainfall for the months April to October inclusive, *i.e.*, the growing period of crops, was 773 points, which is much below the average for many years past.

The Coming Harvest.—Hay-cutting will be commenced immediately. Grain crops, where long enough, will be cut with a binder and threshed on account of the very high value of straw this season.

The following areas promise fair returns:—

200 acres of shandy hay (Algerian oats and Warden wheat), estimated return 30 cwt. per acre.

140 acres of oaten hay (Algerian oats), estimated return 1 ton per acre.

90 acres of barley (Oregon Cape), estimated return 18 bushels per acre.

220 acres of wheat varieties for distribution to farmers as pure seed, estimated return 14 bushels per acre, in addition to

100 acres of Experimental wheat, oats, and barley crops.

Total 750

In addition to above crops, 60 acres have been seeded to rape, and 300 acres are under irrigation, sown with lucerne and grass mixtures.

It has become very apparent that the dry season lasting till the relief rain that fell on 21st and 22nd October has had a very disastrous effect on the crops and the dry farming area. White heads can be noticed throughout the entire areas, and the crops generally had no opportunity of stooling, and are therefore thin as well as very short.

The making of lucerne hay has been the first harvesting operation of the season. During the month approximately 25 tons were harvested from an area of 26 acres. The weather during the earlier part of the month was very favorable for this work.

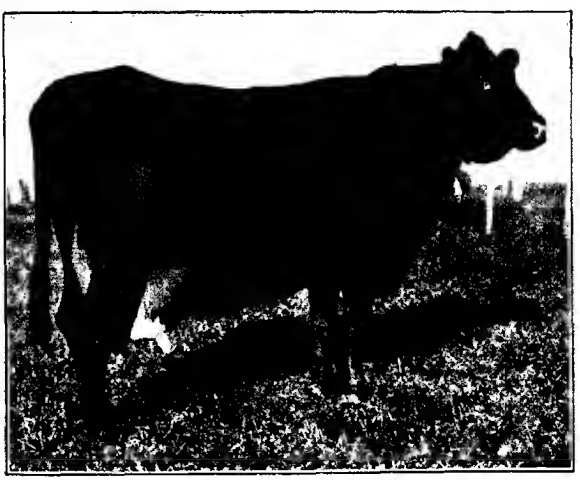
Generally the first crop of lucerne is regarded as inferior in quality on account of the presence of weeds and grass. This season, however, a very clean sample of hay has been gathered from the first cut.

Cultural Operations.

Fallowing.—During the month the fallowing of 100 acres was completed. This brings the total to 650 acres, and finishes the work for the season.

Cultivation of Fallows.—One hundred and fifty acres of the early fallows have been harrowed, and this work of cultivation will be continued whenever horses are available throughout the harvesting months.

Lucerne Seeding.—Seventy acres of lucerne on irrigation land has been drilled during the month with 12 lbs. lucerne seed and 1 cwt. of superphosphate per acre. This operation was carried out by means of the ordinary seed drill, and half the amount of seed manure was sown each way across the field at right angles.



Muria, of the State Research Farm Red Poll Herd; died during October.

Lucerne Renovations.—One hundred acres of lucerne has been top-dressed during the month with 2 cwt. super per acre. This completes the area under irrigation to be renovated this season.

Live Stock.

Horses.—Sixteen foals by the Clydesdale stallion, Baron Wigton, have been dropped to date. These foals seem a particularly fine lot, and are the first that have been got by this sire since his addition to our stud. Thirty of the farm mares are being put to Baron Wigton this season, together with 20 farmers' mares of the district.

By the addition of this season's lucerne hay to the ration which is being fed to the draught horses of the farm, a very marked change in

condition has been noticed. The animals have put on flesh considerably and dropped their winter coats.

Cattle.

Unfortunately I have to report that our high butter-fat producing cow, Muria, whose record has not been beaten in Australia, died during the month. She did not show signs of any ailment and died suddenly while grazing on a lucerene area.

Muria, which had reached her fourteenth year, produced from 25th July, 1914, to 25th July, 1915, 14,972 lbs. milk, 884.16 lbs. butter-fat, and 1007.94 lbs. commercial butter, computed on 14 per cent. overrun The average butter-fat test during the whole period was 5.91.

Muria's Government Test Records.

Year.	lbs. of Milk.	Test.	Butter Fat.	Standard.	Milk Yield Last Day.	Days in Test
			lbs.	lbs.	lbs.	
1914 ..	7,287	5	364·76	250	14½	273
1915 ..	12,297½	5·74	705·88	250	30	273
1916 ..	9,993½	5·43	542·50	250	24	273

Milking Herd.—Fifty-four cows have been milked during the past month and have gradually increased in yield. At present 150 gallons of milk a day is produced. The increasing yield is no doubt due to the fact that we have been able to feed much more regularly during the past month with lucerne both grazed and as hay.

Sheep.—Considerable reductions have been effected in our flocks during the past month. Two trucks of fat crossbred ewes, averaging 25s. per head, and two trucks of this season's lambs, averaging £1 per head, were marketed.

This now leaves on the farm—

700 crossbred ewes.
160 crossbred lambs.
260 Border Leicester studs.
80 Suffolk studs.

With the exception of the Border Leicester flock ewes, all sheep on farm at present are shorn.

The average price of the fleece wool appraised on 17th October was 17d. per lb.

On 28th October 630 full-mouthed crossbred ewes were mated with eight Border Leicester 2-tooth rams and eight Suffolk 2-tooth rams. These ewes have been two months shorn, and the object of the early mating is to insure our having fat lambs next season that can be put on the market in July and August, when new season's lambs are scarce and usually command special prices.

In using equal numbers of both Border Leicester and Suffolk rams we are testing the prolificacy of these breeds as sires. In years past it

has been found that the Suffolks are particularly vigorous at mating time, and it will be interesting to see how the young Border Leicester rams will compare with them in this respect under identical conditions. This mating also affords a comparison in the two breeds as fat lamb producers.

Irrigation.

Irrigation has been carried on during the past month, and the whole of our established lucerne and sown grass areas have now received their second watering. The results point to a heavy harvesting season.

A field of 26 acres, which was irrigated in early August, was harvested during the month and yielded approximately 25 tons of clean, good quality hay, and other fields, totalling 150 acres, will be cut within a fortnight.

Notes on Experimental Plots, Werribee Research Farm, October, 1919.

By George S. Gordon, Field Officer.

The early sown crops are the most promising, and the October rain will be of more use to late varieties than early ones; but, on the whole, this year's tests will be instructive regarding moisture and drought-resistance rather than the prolificacy of the crops under normal conditions.

Green Manurial Rotation Field.—The second "feed" on the rape, barley, and oat plots in this yield has been completed, and the rain will enable a further one to be obtained before the plots are summer fallowed for next season's wheat crop. The peas plots are now being fed off for the first time this season. In the wheat section for 1919 the crops following the "ploughed-in" crops of rape, barley, peas, and rye and vetches are looking better than those on the plots where similar forages were fed off in 1918. To some extent, this is probably due to the later ploughing, and therefore somewhat inferior texture of the soil on the "fed-off" plots. The best wheat plots at present appear to be those following:—(1) Peas, (2) rape, and (3) bare fallow, while the worst are those following barley.

Permanent Manurial Field.—All the superphosphate dressed plots in this field show out to advantage, and the growth varies according to the amount of fertilizer which each received. The plots receiving the heaviest dressings of superphosphate are the most forward. The crop on the manured plot, besides being thin, short, and spindly, is only in the "short-blade" stage of growth, while those that received superphosphate are not only in head, but most of the plants are well past the flowering stage and show greatly increased growth. In addition to the larger yields obtained from the fertilized plots owing to the plant food supplied by the super, the earlier ripening is of value in many districts, as it helps the heads to "fill" with plump grain before the hot drying winds of summer draw off the moisture from both soil and plants. Harvesting can also commence earlier.

Variety (or "Seed") and Selection Plots.—In common with the other sections, these plots have suffered by the dry season, but the new cross-bred wheats "Gallipoli" (Club x Yandilla King) and "Graham"

(Indian 8 x Comeback) are holding their own well. The average yield of these crossbreds in ½-acre plots at Werribee during the past four years in comparison with standard wheats such as Federation and Yandilla King is as follows:—

Gallipoli, 20.9 bushels per acre.
Graham, 20.6 bushels per acre.
Yandilla King, 18.7 bushels per acre.
Federation, 17.8 bushels per acre.

The bulk, Gallipoli, at present grown in large plots, is not absolutely fixed in type, but it must be admitted that any wheat which can yield a bag to the acre more than Federation, as shown above, must have some inherent prolific quality in its composition worthy of testing and developing to the greatest possible extent. To this end, sixty selections of Gallipoli were last year grown in Centgener rows and carefully noted, harvested, &c. Seed from the best of these, together with a number of other selections made last year, were sown in this year's Stud Cereal and Long Row plots. These new selections are now giving promise of improved type and probably even better yields. The grain is also attractive in appearance, and in competition with other varieties a bag of Gallipoli, exhibited by the Research Farm, was awarded first prize at the recent Werribee Agricultural Show.

FARM NOTES FOR OCTOBER.

RUTHERGLEN EXPERIMENTAL FARM.

By P. B. O'Keefe, Manager.

The weather for the month has been exceptionally dry, only 68 points of rain being recorded, whilst the average for a number of years is approximately 2 inches. This diminished rainfall, following on the droughty conditions prevailing for the past twelve months, and coupled with the fact that last year's fallow season was so very short, has caused the almost total failure of the majority of crops throughout the Rutherglen district. Only those planted on fallow land will give a fair return, while the crops on land ploughed just previous to seeding will not be worth harvesting. Up till the 20th of the month prospects seemed fair, but on the date mentioned we experienced a scorching hot day with raging winds, which culminated in a precipitation of a slight rainfall (almost 2 points); this blasted the hopes of any but a very light return from crops sown on unfallowed land.

The position with regard to pasture is not so serious. Practically all stock is, so far, in good condition. Ewes for the most part are fat enough for slaughter, but lambs are, if anything, a little backward in condition. It is hard to understand the reason for this; it is possibly due to the fact that dams are very low, and that the lambs are not taking

sufficient water, or perhaps the ewes may not be drinking enough with the result that the milk yield is limited.

Though the stock is in good condition, the outlook for the future is not promising. Pasture supply is limited, and unless we have a good fall of rain within a month or so, there will be something approaching a water famine among those stock-owners who depend on tanks and dams for their supplies. The more provident farmers are taking advantage of the dry spell to clean out and deepen their dams, to lessen the chances of a recurrence of the shortage.

Pasture and Fodder Supply.

Grass paddocks are carrying a fair sole of feed. Rape crops are being spelled, and will probably provide a green pick later to carry us on till stubble is available. On account of the leanness of the season, it has been difficult to provide a good bulk of feed, and rape crops, though their yield has been light, have given a fresh bite at a critical period.

Millet planted in No. 12 has not appeared above ground, and no return is now expected from it.

Crops.—The rainfall from 1st May to 31st October of the present year was 7.56 inches, the greater part of which fell in May and June. The crops promised well in September, but the continued hot dry weather has since destroyed hope of a bounteous harvest. In the south end of No. 10 field, 60 acres of fallow, which was planted with Algerian oats, will yield about 30 cwt. of hay per acre. Field No. 8, planted with barley, at south side, will average about 10 bushels per acre; whilst Warden wheat should yield 30 cwt. of hay per acre. One silo (110 tons) has been filled with forage. In addition, there are seven straw stacks, which, if necessary, will be damped with molasses solution and fed to stock to supplement the hay and silage cut this year.

Paddocks No. 5 (25 acres), No. 13 (45 acres), and No. 15B (30 acres), sown with Federation wheat, will probably average 10 bushels per acre.

Fodder Crops.—Fifty acres of rape in No. 14 has been fed off, whilst a further 50 acres in No. 15 is being reserved to assist in tiding us over the period until stubble paddocks are available. Lucerne planted in Wallace Paddock is making very poor growth, and requires a good downpour to bring it along. According to present indications, it will be necessary to replant it in autumn if weather conditions are then favorable.

Live Stock.

Horses.—All horses except those actually being used have been turned out to grass. Horse-work in vineyard has been completed for the season, which will allow a further reduction in the number to be hand-fed.

Dairy Herd.—Dairy cows and young stock are in good condition, the milk yield from cows being 25 lb. per head per day. The fodder fed to the herd consists of green oats and peas along with natural pasture.

Sheep.—Shearing is finished, and the wool has been forwarded for appraisement. The clip was quite equal to last season in quality, the

quantity being a little in excess. Ewes with lambs at foot are in splendid condition; three of them were awarded first prize in pen of fat sheep at the local Show. Lambs, however, are not doing so well. The slow development may be due to lack of pure water, and an endeavour is being made to keep them on paddocks where they will have access to troughs supplied by well at Black Dog Creek.

Border Leicesters.—These have lambed very irregularly, the lambing period spreading over several months. As in the case of flock ewes, lambs lack the bloom of past seasons. One hundred and fourteen per cent. of lambs were dropped.

Weaners, which are being fattened on Experiment Field, are doing well; these were purchased at Wangaratta during June for 13s. 11d. each. They returned 6s. worth of wool, and now weigh 90 lbs. each live weight.

Swine.—Thirty-seven pigs are now on hand. Ten baconers and a back fatter were sold at Wangaratta market on 21st; the baconers realized £4 14s. each, and the back fatter £10. A further twenty-five stores are coming on well, and should be saleable within the next two months. The Experimental Plot of artichokes planted near stye are well above the ground, and look very vigorous.

EXPERIMENTAL PLOTS.

By T. M. Whelan, Field Officer, Rutherglen Experimental Farm.

Stud Cereal Section.—This area is looking well and showing a tendency to ripen. Fields in these single rows look very promising, showing the good effect of regular intertillage.

Rotation Section.—Wheats in this section were in the early part of the month superior to fallows, but since the 20th, which was a very trying day, they have gone off considerably, whilst fallows continue to make vigorous growth and show no bad effect from the dry conditions prevailing.

Permanent Fertilizer Trials.—The plots manured with stable manure alone show to much better advantage than those fertilized with stable manure and lime, the latter showing a tendency to burn up under existing dry conditions. In all cases where nitrogenous manure has been applied in any shape or form the crops show to a more marked degree the effect of drought. In Plot No. 8, however, where the nitrogenous element was broadcasted in spring, the effect is not so noticeable.

The plots given the heavier dressings of phosphatic manures appear to advantage, though the theory is generally accepted that heavy dressings of "super" tend to burn the crops during dry seasons.

Cultural Trials.—In this section the well worked fallow shows to advantage, and is in striking contrast with plot ploughed at seeding time. This latter is a miserable failure, not being equal to farm areas put in under similar conditions.

Variety Wheat Trials.—In this section early maturing wheats are considerably better than late maturing varieties. Four stand out prominently, viz., Crossbred 4, Comeback, Gluyas, and King's Early.

Silage Crop.—The 3 acres seeded for silage at the north end of Field No. 2 yielded about 36 tons of green stuff, equivalent to about 9 tons of hay; this amount and the green oats from Field No. 4 filled the all-wood silo.

Cultural Operations.—All fallows have been spring-toothed and levelled down with spike roller. As portion of Field No. 2 was very foul with wild oats, it was fed off with sheep prior to cultivating. This should insure a cleaner wheat crop next season.

No. 3 Field.—Barly and early maturing wheat in this field are ripening rapidly and point to early harvesting. They are fairly well headed and should give a fair yield.

Graded Seed Tests.—In these the marked difference noticeable at germination in favour of graded seed seems to have entirely disappeared, and the quantity and quality of grain harvested will be watched with interest.

In the early sown plots of Sunset wheat the yield promises to be light, whilst in the later-sown the prospects are good. In practically all cases the early-maturing varieties have done best this season.

Flax.—All flax plots are ripening evenly; early sown is maturing well and shows no ill-effect from drought. According to tests conducted at the Glass House the water requirements of this plant from its flowering stage are considerably less than that of cereal crops.

Feeding-off Tests.

The plots were graded as follows:—On 15th inst., 25 weaners, averaging 82.4 lbs., were put on Plot No. 30, and 26, averaging 83 lbs., were placed on Plot No. 19. They were left there for twelve days, when plots were cleaned up; the lambs were then weighed, and the former showed an increased average weight of 7.8 lbs., and the latter a gain of 6.0 lbs., a total increase of 351 lbs. for the lot, which at 5d. per lb. equals £7 6s. 3d., or 2s. 9d. per head.

It was noticeable that these sheep first ate out wild oats and other grass before taking to the Wimmera rye-grass, which may have been a little over-ripe. However, when they commenced to eat the rye-grass they appeared to relish it. Possibly when acclimatised this grass will do even better than it has in this test.

A NOTE ON THE ECONOMY OF SILOS IN FARM MANAGEMENT.

[The following article is reprinted from the *Journal of the Royal Agricultural Society of England*, Vol. 79, pages 120-3. Except for the difference in the time of the seasons the article applies equally to Victorian as to English condition.]

The most important problem of the present time for those interested in Farm Management is how, and by what means, the increased wages

bill is to be met. It is essential for the benefit of the country at large, and especially for the populous and over-crowded towns, that the production of the soil should be increased, not only above pre-war times, but that it should be maintained at a higher productive standard than it has attained to at the present day. With an abundant supply of potash and other artificial manures, with the arable lands being thoroughly cultivated and cleaned of weeds, in addition to being drained where necessary, and with a considerable increase of labour, there is no doubt that it is a possible and not a difficult matter for the agricultural production of this country to show a substantial increase. In bringing back our lands to similar fertile conditions as was the case in the sixties, it must be recognised that manual labour plays an important part. In fact all the farming operations already mentioned as desirable to restore the fertility of our soil are dependent on labour. With the establishment of the Wages Board, resulting probably in shorter hours, and certainly in increased pay, labour is not the same cheap commodity it was even before the commencement of the war. Neither would one wish to see it. Farmers as a rule welcome the advent of a better time for the farm hands—good cottages, and more time to devote to their home duties—and they raise no objection, provided that prices will be maintained at such a point as to allow a fair profit, together with interest on capital and working expenses connected with farm management.

The question therefore arises how is the cost of labour to be met in the future, or rather, how is labour to be economized? One naturally turns to labour-saving machinery and labour-saving methods of farming, and it is in connexion with the latter point that a consideration of the economy of silage is involved. Silage has generally been regarded as an alternative to the hay crop, but it is as a substitute for the root crop that it is now being extensively used in the eastern counties. Of all the purely agricultural crops on the farm none require so much labour as roots. The frequent ploughing, cultivating, and harrowing, all require a certain amount of manual labour, whilst one is entirely dependent upon the farm hands in some form or other for the hoeing, singling, pulling, and carting where necessary; and with this laborious work must be included the pitting, cleaning, and slicing of the roots. From the spring days of April, when mangold seed is planted, till the roots are consumed by the stock in the following spring, labour is required in order that the crop may perform its allotted task. As the conditions of root growing have changed in regard to this important item of labour, can we not profit by the experience of America, where high wages have ruled for many years?

It will be found that in the United States the acreage of roots cultivated for purely agricultural purposes is comparatively almost negligible, and as a substitute for winter feeding to cattle the silo is much in evidence. The making of ensilage is no new idea with the American farmer, but it has demanded increased attention for the last thirty years, and at the present time it is difficult in some districts to visit a farm homestead of any pretensions and not find an up-to-date silo. The feeding of ensilage has become of such national importance in the States that when it was proposed last year to restrict the use of iron and steel by

25 per cent. on the previous years, it caused such a flood of protests at Washington that the following statement was issued:—"The War Industries Board, being mindful of the importance of silos as a means of stimulating production and of preserving food, will look with favour upon their construction," and the proposed 25 per cent. reduction was not enforced. In 1882 there were only ninety-one silos erected in the United States; in 1914 this had increased to 750,000. At a congress in Chicago of the American Meat Packers' Association, the President stated that he was looking to the silo to help to save the situation as regards the threatened beef famine which is in sight in the United States. If, therefore, the silo is such an important factor in America, with similar conditions of labour as our own, must we not seriously consider the advisability of looking into the matter with the object of ascertaining if it is not worth while adopting the silo system in our management of the farm. It may be correctly stated that ensilage was on trial in this country some thirty years since, and did not catch on, yet a few farmers made ensilage then, and have continued to use the silo up to the present time. Undoubtedly the present-day method of making silage is a vast improvement on the old manure-heap practice, with its unwarranted waste. Just previous to the war a few wood stave silos were erected on the American principle in this country, but owing to the restriction on timber during the past few years, this had to be discontinued. Those farmers who were fortunate enough to have their silos erected at pre-war prices have reaped an immense advantage.

Most farmers have a fairly accurate idea of the cost of mangold at pre-war prices up to the time they were carted off the land, but even then there was no allowance made for pitting, carting home, and preparing. During the past four years, the expense in cultivating root lands has enormously increased, and labour which could not be spared from the roots was badly needed elsewhere, so consequently other crops had to suffer for the want of it. As to the cost of ensilage, it was estimated at under 9s. per ton in 1914. In the same year, a silo with capacity for 160 tons was filled with maize, the produce of 12 acres, and it maintained seventy-five head of stock for twenty weeks without any roots—straw and cake being the only additional feed. This works out at something under 1s. per week per head; but it must be added some ten calves were included in the number, the rest being twenty-five milch cows and some of their produce as yearlings and two-year-olds.

Like other commodities, one can readily understand there is good silage and bad silage; some which animals will readily consume, and some which does not appeal to stock. Decayed and mouldy silage it is not advisable to feed, and given to horses may result in serious loss; and as it is difficult to avoid at times pieces of mould getting into the manger, it is not recommended as a feed for horse stock, but to all cattle, sheep, and swine it may be fed with the greatest confidence and with excellent results. But it must not be forgotten that there is a considerable wastage of food-values in the process of making silage. Lawes and Gilbert found that in a stack silo this loss amounted to no less than 30 per cent., and the analysis of maize silage in a stave silo at Wye showed likewise that the chemical changes were attended with serious depreciation of value.

The system of silage farming can be applied to all varieties of soil, but it appears to have special advantages on wet, heavy land and on light sandy—the two most difficult classes of land to cultivate at a profit. On the heavy soil, the wheat stubble can be ploughed up in the autumn, it can have another ploughing at the end of March, and maize can be ploughed in at the rate of 2 bushels per acre by means of a small drill attached to the plough about the middle of May. In a dry spring a fallow will have been made of the land, and if, as is customary, every alternate furrow is planted, the single furrow hoe will soon be able to commence work between the rows and the more this implement of husbandry is in use the better the crop, the fewer the weeds and the better condition the soil will be in for the following crop. On the poor light land soil, oats and tares, at the rate of 1 bushel of the former to 2 of the latter, with a few beans to hold the tares up, can be drilled in the early autumn, and with twice harrowing in the spring no further expense is necessary till the crop is ready to place in the silo. In June the soil is then broken up and usually a crop of turnips or mustard can be obtained. Most farmers, carrying a flock of breeding ewes on light soil, know the difficulty of obtaining feed of a succulent nature in a dry July when all crops are parched from a prolonged drought. With a full silo there is no scarcity, and one great advantage of silage is that if it is not required one year it can be used the next. At the present time over-yeared silage is being fed on an adjoining farm, and, to all appearances, it is equal in quality to that consumed the previous year. Dairy farmers were at one time under the impression that the smell from silage might be detrimental to the keeping of milk. Such, however, is not the case; some milk sellers who have continually fed silage during the winter months for many years past have never had a complaint in this respect from their London buyers.

In 1886-7, some experiments were carried out by Dr. J. Augustus Voelcker on behalf of the Royal Agricultural Society at Woburn, the special object being to ascertain the value of grass silage as against grass made into hay. The results arrived at after feeding two lots of bullocks, one on silage and one on hay, appear to have been only slightly in favour of silage. This is not surprising, considering grass is not a suitable crop to put in a silo. However, one can really see that a crop of oats and vetches (tares), grown on arable land in practically half a season, will show a considerably better result than a crop of grass converted into silage. The *Journal of the Board of Agriculture,* of May last, in giving the advantages of silage, states:—"Stock fed on silage made from leguminous crops, *i.e.*, clover, lucerne, sainfoin, and vetches, will require less oilcake than stock fed on roots; moreover such crops tend to increase the fertility of the land." "The labour involved in feeding silage is very much less than that of feeding roots."

The two items mentioned, increasing the fertility of the soil and economizing labour, are two points which no one can afford to overlook in the present-day management of the farm, and the experience of many farmers in the eastern counties is that silage is an aid to the attainment of both these ends.

CO-OPERATION FOR FARMERS.

Some time ago we pointed out to farmers, especially to those just settling on newly-acquired land, the many benefits which some system of co-operation in the work of clearing the land, planting, harvesting, and marketing the crops, and various other matters incidental to the farming business. In the past, and, to some extent, at the present day, neighbour helped neighbour, and the help was reciprocated to their mutual benefit. Where this was not the case, each individual producer made use of animal power far in excess of what is absolutely required to effect the object in view. The same theory holds good with respect to clearing, fencing, stumping, and many other works on the farm. We see strong men toiling single-handed at a work which, with the help of a couple of neighbours, could be done in a quarter of the time, and without any of the exhausting labour otherwise required. As an illustration which will commend itself to all scrub farmers, let us take the work of burning off. Sometimes a lucky burn will leave very little after-work to be done, but often a very bad burn happens, and every stick of timber almost has to be handled. A man working alone must do a tremendous lot of axe-work to enable him to pile up the timber in heaps. He has to cut the logs into lengths such as his strength is equal to carrying. He will thus make but a small impression by the end of the day on a 5-acre patch of badly burnt scrub. Now, suppose that he has a dozen neighbours all employed at the same work, or even on a different class of work, such as stumping, pulling or husking corn, digging potatoes, or planting some crop. If these men would all combine to assist each other, it is clear that the work of burning off would be enormously lightened. A tree which the individual would have to cut up small, to enable him to deal with it, would be picked up bodily by six men and carried off with ease, all the axe-work being saved. It might be argued that, while these men are helping their neighbour, the work on their own farms is at a standstill. So it is—for a day or two, but now those who assisted the first man are in their turn assisted to plant, gather the crop, bale their hay, or to do any other work which may be pressing, and, so far from their having lost any time, their own work is far more expeditiously done by the assistance thus given. Again, take the case of a man having 10 acres of lucerne cut and just ready to cart in. Every one knows the disastrous effect of heavy rain on lucerne hay lying in the field. Rain is threatening, and the individual works himself and his horses from dawn to dark, and then finds that he cannot save his crop; but the neighbours come along with their teams, and the whole is safely got in before the storm. This is the commencement of co-operation, and it is easy to see how it works beneficially to all concerned. Now we go a little further, and come to marketing. In the neighbourhood of towns it is a common thing for a man to yoke up a horse, or perhaps two, to cart in three or four bags of corn, some potatoes, cabbages, eggs, &c. This takes the whole day probably, and he expends sufficient labour on the business to perform double the work. His neighbours do the same thing. Now, if we count up the hours so lost by each individual, reckon the labour

which all those horses and men could have got through in the day, and add to this loss the probable expenditure of a few shillings on creature comforts in town, we shall find that the sum total will amount to more than the profit on the goods sold. If all those men were to combine and send their produce to town in a couple of big waggons, in charge of two or three of themselves, the work would be equally well done, and at a minimum expenditure of cash and labour. Why should every housewife collect a few dozen eggs, a few pounds of butter, honey, and other minor farm products which are her own particular province, and at the week's end drive to town with a cargo weighing, perhaps, a hundredweight? Would it not be far more profitable for all if these things were handed over to one individual to take to market and dispose of? There would be no middlemen's profits, no commissions to come off the returns, and thus there would be an end of what is not unknown to many farmers—namely, an account sales, with expenses piled up to a greater figure than the sale money, and a respectful request to the sender to remit the balance. Here, then, is where co-operation comes in again.

Some think that a co-operative store would be a panacea for the disabilities upon which farmers labour in the matter of disposing of their produce and purchasing supplies. But it should be remembered that a store, to be a financial success, must be managed by smart business men. Farmers may be shrewd and intelligent enough, but they have not been brought up as business men—that is, as shopkeeper, financiers, bookkeepers, and commercial travellers; and however carefully a set of directors might think they were managing the business, they must, in the long run, go to the wall. Auction sales are thought to be fair and above-board methods of doing business. But here again the farmer is "euchred." The auctioneer may be a straight, fair-dealing man, anxious to get the best price for the goods he is selling. It is the buyers, over whose bids he has no control, who combine to keep down prices. What is easier than for a lot of professional buyers, all known to each other, to combine to offer up to a certain figure and no higher? The majority of farmers are in a far different position to the wool-grower. If, at wool sales, prices do not suit the seller, he can afford to withdraw his lots and store them. He is not in any immediate hurry. The wool is an excellent asset. It will keep, and money can always be raised on it. The farmer's goods are perishable. If they are not sold, he cannot raise money on many of them. The farmer himself is probably in urgent want of money to carry out some work or get in some crop. The buyers know all this, and thus are able to get the produce at a figure which will leave them a handsome profit. It is little they care for the farmers. The best plan for the farmers of a district is to organize themselves into a society. But they will say they have done this all over the State. There are farmers' associations and butter and cheese factories and creameries, many of these co-operative, in the State. Leaving out the work of these factories, there are the associations and societies. What have these done for the farmers? With the exception of a few, they have done nothing more than collecting subscriptions and holding an annual show, which latter would appear to

be the sole aim and end of most farmers' associations. Now, these societies could do a vast amount of valuable work for their members, provided that those members also do their share of the work. They should act as agents for the farmers; they should have their own reliable agent in every considerable town, to whom they would consign the produce of various kinds intrusted to their care by the farmers. They could arrange sales and prices in advance, by which action farmers would have no need either to hawk their produce, or, if unable to sell, to leave it to rot in the barn or town store. Then, again, the society could act as buyers for their district. Goods bought wholesale are always cheaper than goods bought retail. Thus the farmers could send in orders for 20 tons of seed potatoes instead of paying through the nose for 1 ton. It would be the same with all farm necessaries, including sacks and implements of all kinds. There is no need to enumerate all the advantages this method of supply would bring in its train; they should be sufficiently obvious to all interested in buying in a cheap market and selling in a dear one.

There is, however, one thing which might be done by these societies, which, if well thought out and well carried out, would prove a blessing to many: We allude to the formation of a fund out of which farmers who require a small loan to tide them over a temporary difficulty could be assisted, and that with no loss of self-respect, for they could demand the loan as a right under certain conditions. There should be nothing of the land bank about this scheme. A little farther back we spoke of most men spending a shilling or two in town when bringing in their produce. Suppose that these shillings (which most can well afford, or they would not spend them) were subscribed weekly to a fund operated upon by the president and committee of a farmers' association. In a district where 100 farmers are resident, if each were to subscribe, say, 1s. or 2s. weekly (the eggs would provide so much money and a good deal more, or they should do so, on a well-managed farm), these weekly deposits, to use a convenient term, would, at 1s. per week, produce £260, and, at 2s., £520 in one year. For the first year after the formation of the fund, no borrowing should take place. The money would be placed out at interest for short periods, by which means the fund would be considerably increased. Now, when a farmer wanted a small sum, say from £5 to £25, he could borrow it for a short term at low interest, and repay the principal and interest by easy instalments. The fund would thus take the form of a savings bank, in which the farmer receives interest on his money, and on which he can draw for an emergency on the most favorable terms, fair security being given for the repayment. Such a scheme appears to us feasible, but would naturally require careful elaboration, and could only be successful by the hearty co-operation of the farmers themselves. That the advantages of complete co-operation are not seen and seized upon by all our farmers is one of those things "which no feller can understand." See how easy it works out. A man goes into a shop to buy a pound of tea. The price is 2s. Suppose he took a chest. Then the price is 1s. 8d. And so with all goods, the greater the quantity purchased the less has to be paid. What more need be said on this subject?

—*Queensland Agricultural Journal.*

RAINFALL IN VICTORIA.

Third Quarter, Year 1919.

Supplied by R. F. Griffiths, Acting Commonwealth Meteorologist.

District.	—	July.	August.	September.	Quarter.
		Points.	Points.	Points.	Points.
Mallee North	District Mean	33	39	58	130
	Normal	94	132	147	373
	Per cent. Departure	−65	−70	−61	−65
Mallee South	District Mean	55	70	110	235
	Normal	128	139	166	433
	Per cent. Departure	−57	−50	−34	−46
North Wimmera	District Mean	113	113	161	387
	Normal	170	175	198	543
	Per cent. Departure	−34	−35	−19	−29
South Wimmera	District Mean	160	113	207	489
	Normal	219	223	227	669
	Per cent. Departure	−23	−49	−9	−27
Lower Northern Country	District Mean	68	102	147	317
	Normal	160	171	176	507
	Per cent. Departure	−58	−40	−16	−37
Upper Northern Country	District Mean	80	107	145	332
	Normal	191	205	199	595
	Per cent. Departure	−58	−48	−27	−44
Lower North-East	District Mean	116	146	202	461
	Normal	313	273	273	859
	Per cent. Departure	−63	−47	−26	−46
Upper North-East	District Mean	274	214	390	878
	Normal	475	452	442	1,369
	Per cent. Departure	−42	−53	−12	−36
East Gippsland	District Mean	217	662	384	1,263
	Normal	235	206	285	726
	Per cent. Departure	−8	+221	+35	+74
West Gippsland	District Mean	240	390	406	1,036
	Normal	291	307	368	966
	Per cent. Departure	−17	+27	+10	+7
East Central	District Mean	300	219	243	762
	Normal	282	289	345	916
	Per cent. Departure	+6	−24	−30	−17
West Central	District Mean	169	146	169	484
	Normal	198	206	280	684
	Per cent. Departure	−10	−29	−40	29

RAINFALL IN VICTORIA—*continued.*

District.		July.	August.	September.	Quarter.
		Points.	Points.	Points.	Points.
North Central ...	District Mean ...	171	161	197	529
	Normal	271	275	291	837
	Per cent. Departure ...	−37	−41	−32	−37
Volcanic Plains ...	District Mean ...	217	177	256	650
	Normal	227	235	289	751
	Per cent. Departure ...	−5	−25	−11	−13
West Coast ...	District Mean ...	326	277	358	961
	Normal	333	318	329	980
	Per cent. Departure ...	−2	−13	+9	−2

LIMING FRUIT TREES

There is no doubt that much loss of fruit is attributable to lack of lime in the soil, the "shanking," or falling, of half-grown stone fruits being most frequently due to the absence of this essential element. Quicklime is the best form to use, and after slaking it should be spread over the surface during winter at the rate of 30 pounds to the square rod. Most soils not containing natural lime may be given this dressing every second or third year.

Before applying the lime it is well to see that the ground beneath the trees is raked clear of all rubbish, for the latter contains the pupæ of many insect pests, which if left undisturbed will attack the trees in spring.

Whilst winter washing of orchard trees with caustic alkali is undoubtedly good practice, the average farmer seldom has the time or the tackle with which to apply such sprays to his fruit trees. A lime-sulphur mixture, which may be painted over the trunks and larger branches, is a useful substitute and one that anyone can use; the object being to remove mosses and lichens and so destroy the hiding-places in which they conceal themselves.

The following is a good formula: Place 10 lb. of fresh quicklime in a tub capable of holding 50 gallons. Pour enough warm water over the lime to cover the latter, and as soon as slaking begins add 8 lb. of flowers of sulphur, stirring thoroughly and giving more water if necessary. Cover the tub with an old sack and let the mixture boil for twenty minutes, stirring occasionally. Then fill the tub up with water, and the mixture is ready for use.

If the liquid so prepared is applied with a spraying machine or syringe, it will first have to be strained; but if only the lower parts of the trees are to be dressed, a whitewash brush will do.

Farmers Union Advocate (N.Z.), 18th Oct. 1919.

THE ICELAND POPPY DISEASE.

By C. C. Brittlebank, Plant Pathologist.

During the past few years, Iceland poppies have been subject to a disease which, in some cases, has killed off 80 or 90 per cent. of these plants in a garden. As a rule, the time of attack, or, at any rate, the time when the disease is first noticeable, is just as, or slightly before, the buds are formed, but plants are liable to become affected at all stages of their growth.

Symptoms of the Disease.

Affected plants assume at first a slightly wilted appearance; later, the base of the leaf and flower stalks become brown, and decay. In mild attacks, a few leaves only are affected, and these dying give the plant a ragged and unsightly appearance. Many of these slightly affected plants throw out numerous tufts of undersized leaves, which cause the plant to become dense and bushy. Such plants seldom, if even, reach the flowering stage, owing to the dense mass of foliage retaining moisture, which is favorable to the development of the disease.

Cause of the Disease.

For some time the cause of this disease was unknown, but early in this year a species of *Phytophthora* was isolated from specimens forwarded to this office. This genus contains the well-known Irish Potato Blight, and several others equally destructive to their respective hosts.

Control.

Complete control of the disease is obtained by the use of copper soda mixture—6 lbs. bluestone, 9 lbs. washing soda, and 50 gallons of water. The mixture is sprayed on the plants, which from their structure convey the liquid to those parts where most needed. Very young plants should be sprayed with a mixture one half strength of that given above.

ORCHARD AND GARDEN NOTES.

The Orchard.

E. E. Pescott, F.L.S., Pomologist.

Spraying.

The spray pump should now be in thorough working order, so that the various spring sprayings may be carried out with as little interruption as possible. It is always wise to clean out the pump after each spraying, so that it will be ready for the next mixture. Putting a different spray in a pump barrel that has not been washed out, very often causes the formation of a sediment, which blocks the nozzle and interrupts the work.

During November it will be necessary to spray for codlin moth, peach aphis, pear slug, and various leaf-eating insects. In addition, black spot of the apple and pear, shot hole, and other fungus diseases must be kept in check. As various sprays are required for all of these troubles, the necessity of always having a clean pump is evident.

At the present time the best spray for peach aphis is strong tobacco solution, and the same spray may also be used for the pear slug. Arsenate of lead is the better spray for this latter insect, but it should not be used when the fruit is approaching the ripening stage; bellebore may also be used for the slug with good effect.

As a preventive against codlin moth, the trees should be kept well sprayed with arsenate of lead. The first spraying should have been given at the time of the falling of the petals; the second spraying, owing to the rapid expansion of the fruit, should be given a fortnight later. After that the grower must use his own judgment as to the necessity for subsequent sprayings. If the moths be at all prevalent, other sprayings will be quickly necessary.

As the woolly aphis is increasing at this time of the year, it will mean a saving of a large number of buds if this insect be sprayed. Nicotine solution, pine spray, or lime sulphur may be used with good effect.

Cultivation.

The work of ploughing and harrowing should be completed immediately. All crops for green manure should be now under cover, and if the orchard soil is at all heavy or stiff, the grower should make up his mind to grow a crop next season, in order that this condition may be reduced.

The orchard should be kept free from weeds, not only for the conservation of moisture, but in order to do away with all hiding places of the Rutherglen fly, cutworm moths, &c.

General Work.

Grafted and newly-planted trees should be frequently examined, and given an occasional watering and overhead spraying, in order to encourage their growth, and to prevent loss of moisture from the foliage. It is also advisable to mulch young trees with light grass, or straw mulching not too rich in animal manure.

The disbudding of unnecessary shoots and the pinching back or stopping of growths, to prevent their becoming unduly long, may now be carried out. This work is particularly important on young trees.

Graft ties should be examined, and the ties cut wherever any growth is being made. Where the grafts are likely to make any long growth, they should be well staked and tied.

Citrus trees may be planted out, and, after planting, they should be watered and mulched.

Vegetable Garden.

Tomato plants should now receive attention every day; laterals will require pinching back; crowded bunches and shoots should be thinned; the plants should be well tied to the stakes, and liberal supplies of water and manure should be given. One or two more plantings of tomato plants may still be made, so that there may be strong, sturdy plants

for the production of late fruits. By planting three or four successions of plants, it is possible to have a good supply of fruits from December to June. Pull up and burn all plants showing any signs of disease.

Celery may now be sown for winter crops. French beans should be largely sown. Cucumber, melon, pumpkin, and all seeds of this family may now be sown in the open.

Where these plants are already growing, the longest and strongest runners may be pinched back, to throw the strength into flowering and lateral growths. Watch the plants for mildew, and use sulphur freely wherever present, especially on the young plants.

Peas, lettuce, radish, turnip, cabbage, and sweet corn seeds may be sown this month. Seedlings from former sowings may be planted out, and it would be well to dip the whole plant in water before planting. This greatly assists the young plants while taking hold of the soil in their new location.

Frequent waterings and frequent cultivation will now be necessary; and all weeds must be hoed or hand-weeded out; mulching with stable manure will greatly assist the plants.

A few beds should now be deeply worked, adding a liberal dressing of stable manure. These plots will then be ready for the celery, cabbage, and other seeds planted during this month.

Flower Garden.

Continue to plant out the various bedding and foliage plants, corms of gladioli, and seed of such tender annuals as Phlox Drummondi, balsam, zinnia, nasturtium, celosia, aster, cosmos and portulaca.

While seeds planted out in the open germinate and grow fairly well, it is advisable during the summer months to plant these in sheltered seed beds, or in a canvas or calico frame. The protection need be on the one side only, preferably the west or north-west; the seedlings are then protected during the hottest part of the day. At the same time the shading should not be sufficient to unduly "draw" them.

The seeds should not be deeply sown, and all waterings should be light. A little water, often, should be the rule for seedlings. Annuals require plenty of room when planted out in the garden. Being quick growers, they are generally gross feeders, and they must have space to develop a good root system. Feeding, too, with liquid manure is helpful when they are reaching the flowering stage.

Dahlias may now be planted out, either from tubers or from young rooted cuttings. These will give good early summer blooms. For autumn and show blooms, the planting should be deferred until the middle of December.

Herbaceous and succulent plants should be staked for protection; included in this section are delphinium, gladiolus, perennial phlox, rudbeckia, &c. These plants will all benefit from liberal mulchings and watering with liquid manure when approaching the blooming period. Spring flowering bulbs, corms, and tubers should now be lifted and stored.

The soil surfaces will now benefit from frequent hoeings and stirrings. Constant waterings will be required if the weather be hot or windy, the cultivation should quickly follow the waterings in order that the moisture may be thoroughly conserved. Mulching with stable manure is also beneficial at this season.

REMINDERS FOR DECEMBER.

LIVE STOCK.

HORSES.—All farm horses in constant work at this season should be well fed with last year's chaff or a mixture of old and new, to which a liberal supply of oats has been added. New chaff or hay alone is not recommended, as it has not the sustaining powers of old hay, and is liable to give rise to digestive troubles. Horses require water at frequent intervals: keeping them for a long time without water, and then allowing them to drink to excess is injurious.

An occasional feed of green stuff will be beneficial. In the event of this being unobtainable, give at week-ends a bran mash, to which is added five or six packets of Epsom salts.

Mares which are away from foals for any length of time should have a portion of milk taken from them before foal is allowed to run with them, otherwise serious results may accrue to foal. Good results follow an allowance of chaff and oats to mares and foals running in paddocks, more especially where feed is short.

At this season the Bot Fly is about, and horses should be frequently examined for the eggs of this fly. The neck, forelegs, and jaws are the parts where the eggs are deposited. Either the use of the singeing lamp under affected parts or the application of kerosene will destroy the eggs.

CATTLE.—Provide succulent fodder and plenty of clean water and shade. The silo is the cheapest method of providing succulent fodder, and costs less than 10s. per ton. Limewash the cowbails, it helps to keep down flies. Provide "lick" in trough, consisting of salt 20 lbs., bone meal 20 lbs., and sulphate of iron ½ lb. Look out for milk fever. Read up method of treatment in *Year-Book of Agriculture*, June, 1905. Have cows' milk weighed, and tested for butter fat. Rear heifer calves from cows giving satisfactory results. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Give half-a-cup of limewater in the milk to each calf. Let them have a good grass run or lucerne, or ¼ lb. crushed oats each per day in trough. Dehorn all dairy calves, except those required for stud or show purposes.

PIGS.—*Sows.*—Supply those farrowing with plenty of short bedding in well ventilated sties. Those with litters old enough may be turned into grass run. *All* pigs should be given a plentiful supply of clean water. Read Bulletin No. 16. Pig raising and fattening with present price of pollard and bacon should be highly profitable.

SHEEP.—When the season is unfavorable, mate only young, well-grown, best-mouthed ewes. When good, join shapely good-fleeced rams with all good ewes procurable. Dispose of all faulty-mouthed ewes, inferior-fleeced wethers, and all coarse-flock sorts of any sex or age, in best condition, and at any time now possible. Those in more favoured areas can replace with younger, better, finer-grade sorts. Where ewe lambs are intended to be held for future breeding, see that the cross results in shafty, fine to medium grade fleeces, as well as a shapely frame. Allow rams to remain with the ewes seven weeks, this period admitting of any ewes coming in season the second time. It is rarely necessary to join more than 3 per cent. of 2 tooths, 3 per cent. of 5 and 6 year olds, or 2 per cent. of 2, 3 and 4 year old rams, unless with young ewes. Where conditions justify it, 4 per cent. of vigorous matured rams with aged coarse crossbred ewes will bring a greatly increased number of twin lambs. Clear wool and burrs from about the pizzles of rams, and cut hoofs into shape before mating. Ewes should be of one breed, or as near one cross as possible, to ensure an even and rapid dropping. Merino and fine cross ewes are in season earliest, first cross or half-breds later, and all ewes with a preponderance of British blood later still. It is useless to join rams with ewes until their proper time of coming in season. Ewes carry their lambs four months, four weeks, four days, or roughly, five months.

POULTRY.—Add a little pealmeal to morning mash and give less bran. Feed equal parts wheat and heavy oats at night. Supply plenty of green food—at this time, lettuce is invaluable. Avoid salt meat of any description. Put Douglas mixture in drinking water when required. Keep ample supplies of sand, ashes, &c., in pens, and moisten same. This will enable the birds to keep themselves cool and clean. Top off geese, ducks, and cockerels for the Christmas markets. Hens will do better this month by having free range. Remove all male birds from flocks, as infertile eggs will keep longer and command a higher price.

CULTIVATION.

FARM.—Cut hay in late districts. Cut oats and barley in early places. Finish planting potatoes. Put in late maize for fodder, also millet and imphee. Plough fire-breaks where required. Get stackyard and stages ready for hay.

ORCHARD.—Keep the surface loose and free. Suppress weeds. Spray as often as necessary for codlin moth and pear slug. Mulch and spray young trees and grafts with water in the early morning during hot weather.

VEGETABLE GARDEN.—Keep the surface hoed, and allow the plants plenty of moisture. Stake, pinch out, manure, and water tomatoes. Pinch back long runners of pumpkin and melon family. Sow autumn and winter varieties of cabbage and cauliflower. Plant out seedlings in cool weather. Sow French beans. Cease cutting asparagus beds, and top-dress with manure.

FLOWER GARDEN.—Plant out dahlias and gladioli for autumn blooming. Lift and store spring flowering bulbs. Stake, tie, and train growing plants. Sow zinnias and asters. Layer carnations, camelias, daphnes, &c. Water well and keep the surface loose. Keep rose beds fairly dry.

VINEYARD.—Inspect young grafted vines (field or bench); suckering and removal of scion roots should be carefully attended to—See *Journals* for September and October, 1917. Tie up young vines. Beware of cut worms on young vines—See *Journals* for July, 1911, and September, 1913. Tying up of bearing vines, if practised, should be completed early in month. Avoid excessive and indiscriminate topping, far too frequent in Victoria. Scarify, if soil is not sufficiently loose, and after heavy rain or irrigation. Look out for oidium and repeat sulphurings on first appearance of disease. Keep a sharp look-out for Downy Mildew.

Cellar.—Fill up regularly and keep cellars as cool as possible.

INDICATIONS are that the two dreaded foreign foes of wheat, flag smut, and take-all will not become widespread in the United States. The United States Department of Agriculture announces that the two States where these diseases appeared, Indiana and Illinois, have taken steps that will prevent the spread of the diseases from the infected fields, and that should wipe out in a few years the infection in fields where it exists.

Indiana officials came to the recent hearing in Washington with adequate safeguards already placed. Shortly after the hearing, Illinois established similar safeguards. All the infected wheat in both States is under control and will be disinfected before any use whatever is made of it. All straw and stubble are to be burned, thrashing machines are to be thoroughly disinfected, and no wheat is to be grown in infected areas for several years.

—*Service and Regulatory Announcements*, United States Department of Agriculture.